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The research in this project was devoted to developing a methodology having utility for an ultimate purpose of identifying potential future toxic substance pollution problems. An approach was desired that would be systematic, comprehensive, and futuristic. The methodology that has resulted is an economics-based one that initiates the identification of problems by focusing on the potential for their occurrence in the production, exchange, and consumption of goods and services.

The methodology was developed and tested by exercising the various components. The steps in the approach are to rank products (exchanged in the marketplace) according to the potential they have for being associated with future pollution problems. For the high ranked products, additional information on the chemical constituents of the product are identified. The final step is to analyze the chemical constituents to determine which chemicals occur frequently and in large quantities. At the same time the potential that each of the chemicals has for resulting in toxic substance problems would be assessed.

In ranking the products parameters on historical growth, future growth, dispersion technical change, and value of shipments were developed and used. A specific group of products was examined to determine their chemical content. The results of this effort showed that identifying chemical constituents of products required considerable resources. The final step of analyzing chemicals to determine frequency and quantity was developed conceptually but due to resource limitations could not be applied.

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DEVELOPMENT OF AN ECONOMICS-BASED METHODOLOGY FOR PROJECTING FUTURE POLLUTION PROBLEMS

by

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The research in this project was devoted to developing a methodology having utility for an ultimate purpose of identifying potential future toxic substance pollution problems. An approach was desired that would be systematic, comprehensive, and futuristic. The methodology that has resulted is an economics-based one that initiates the identification of problems by focusing on the potential for their occurrence in the production, exchange, and consumption of goods and services.

The methodology was developed and tested by exercising the various components. The steps in the approach are to rank products (exchanged in the marketplace) according to the potential they have for being associated with future pollution problems. For the high ranked products, additional information on the chemical constituents of the product are identified. The final step is to analyze the chemical constituents to determine which chemicals occur frequently and in large quantities. At the same time the potential that each of the chemicals has for resulting in toxic substance problems would be assessed.

In ranking the products, parameters on historical growth, future growth, dispersion, technical change, and value of shipments were developed and used. A specific group of products was examined to determine their chemical content. The results of this effort showed that identifying chemical constituents of products require considerable resources. The final step of analyzing chemicals to determine frequency and quantity was developed conceptually but due to resource limitations could not be applied.

The application of the methodology to a limited sector of economic activity, e.g., Chemicals and Allied Products, resulted in the identification of products that ranked high as potential sources of future toxic substance pollution problems.

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SECTION I

CONCLUSIONS

The approach for projecting potential future toxic substance pollution problems that is developed in this research is designed to be comprehensive, systematic, and futuristic. In this regard it differs from other approaches for identifying future pollution problems that are presently used (or are being developed) by others. The major findings of the effort are:

- A computerized, economics-based methodology is feasible and has been developed. It can be used to screen and rank products as to future pollution potential.
- Computerization of the steps in the methodology is necessary because of the large amounts of data that must be processed.
- Comprehensiveness of the methodology is obtained by utilizing the Standard Industrial Classification code, which catalogs all economic exchanges, as the basis for examining economic activity.
- Data sources with futuristic content such as input-output can be used to develop indices for ranking products.
- Results of the analysis of chemical constituents of products show that this type of analysis is very resource intensive. Because of this, it is probably advantageous to perform this step only after products have been screened and ranked on the basis of economics-based criteria.

SECTION II

RECOMMENDATIONS

Because the research in this project was exploratory, one of the objectives was to identify directions that could be taken to improve and implement more fully the approach developed. In general, the results indicate that the approach shows promise for producing useable results. As a result, the major recommendation of the authors is that development and application of the methodology be continued. More specific recommendations include:

- The parameters that are used in the ranking should be further studied to determine whether they are optimum or should be replaced by more powerful parameters, e.g., some of the selected parameters may be redundant. Assessment of the sensitivity of the results to various parameters would provide evidence for this analysis and an improved set of parameters could be established.
- Additional effort is warranted toward improving the weighting procedures because the weighting of the parameters that is used to rank products is critical to determining the rank of products. The weighting process was experimental and the judgment reflected by the weights is limited to staff members who were involved in the project. The base of experts whose judgments is incorporated should be expanded by including persons representing a wider variety of interests in toxic substances. This would include persons from both industry and government. In addition, the weighting procedure could be improved by performing statistical analyses of the incidence of pollution problems from products. In this context, products would be ranked by criteria reflecting known pollution problems emanating from the production, exchange, or consumption of the product. Then, the statistical relationship of the rank to various characteristics of the product such as historical growth rate, dispersion, technical change, and quantity (or value of shipments) could be established.

The findings of this effort would be used to establish specific statistical coefficients for the ranking parameters.

- Analysis of the chemical constituents of products should continue for the products that ranked high according to the economic parameters.
- The procedures for analyzing the incidence of chemicals in high ranked products should be developed to the point that they can be computerized. Computerization will facilitate handling the large number of chemical constituents that are likely to be identified for the subject products.
- The indices that are developed for each of the parameters and are used to rank the products could be improved by testing the ranking obtained with a subject index with a ranking that is obtained using an alternative formulation. As consistency among various alternative forms is achieved, confidence in the subject indices for various parameters will be improved.
- The procedure for normalizing the data used in the indices is very simplified at the present time. This procedure could be improved to make the ranking achieved for various parameters be more consistent with other parameter rankings. This can be done by developing an algorithm to insure that the means and medians of rankings coincide and that the distribution about the mean is relatively consistent. In particular, distributions that are highly skewed due to unusual nonnormalized data should be adjusted for.
- The output format of the computer program could be improved to include more information on the mean and distribution of the individual rankings. This would facilitate the analysis of the results of the product ranking.

- The entire procedure for identifying materials or products of concern, viz-a-viz, future pollution problems, should be applied to another pollutant category (air, water, solid waste, etc.) to test applicability to other problem areas.

SECTION III

INTRODUCTION

In its role as a regulatory agency, the Environmental Protection Agency must anticipate, for the purpose of exerting control, pollutants that might cause adverse effects on human health or the environment. Consequently, EPA must be concerned as to where new pollution problems are likely to arise. Similar concern by other Federal agencies is clearly evident. Preparations to face such future problems and efforts to obtain advance warning regarding where these problems are likely to arise, although difficult, are being addressed in various ways. Approaches that are now being applied range from those that are highly intuitive to those that systematically examine numerous avenues from whence problems may arise. While the intuitive approach is very powerful, it suffers from a lack of comprehensiveness that a highly systematic review would produce. Highly systematic approaches cover virtually all candidate pollution-causing stressors but are generally limited to dealing with those that are known (or judged) to be potential future pollution problems.

The approach for identifying future pollution problems that is developed in this program is intended to fill the gaps that are left by the application of the existing or known methods. This study attempts to develop an approach, hitherto untried, for guiding efforts aimed at identifying future pollution problems. Because toxic substances are of immediate concern as a category of such problems, the approach will be developed with this area of application in mind. The approach is based on identifying future material categories of concern at the source as they are produced, exchanged, or consumed in the economy. Data on the economic characteristics of particular material categories (products) are collected and organized with the aim of determining those categories that should receive priority in any intensive search for future toxic substances (or other pollution problems) requiring regulation. The approach is designed to be futuristic, systematic, and comprehensive.

Futuristic

In developing the methodology it is necessary to first define what is meant by future problems. Figure 1 indicates the conceptual relationship between future pollution problems and problems known today. The circle indicated by P_{1975} represents all pollution problems (known and unknown) today. The circle P'_{1975} represents the known pollution problems of today. The remaining area in P_{1975}, namely A, D, represents unknown present pollution problems. The circle P_{1985} represents all pollution problems of a future date, 1985. The area A represents unknown pollution problems of today that will not be problems in 1985. This may be due to obsolescence of technology and/or changes in life style. Area B represents pollution problems that we know about now but which will disappear by 1985 due to our attempts to deal with them or because of changes in our activities, perhaps quite by accident. Nevertheless, these are problems today but they will not be problems in 1985. Area C represents those pollution problems that are known today but which will have eluded our attempts to deal with them and will remain problems in the future. Area D represents problems that exist today but which we have not been able to detect or identify. In 1985 these will still be "fair game" as pollution problems that must be dealt with. Area E represents future pollution problems that will arise between now and 1985. These problems will arise for all the reasons that the set P_{1975} will change to the set P_{1985} over time. In particular, changes in life style, changes in technology, changes in values, and changes in the demand for various types of goods and services are examples of the forces that will lead to the redefinition of the set of pollution problems.

From this diagram, it is possible to indicate which problems the methodology is meant to deal with. Clearly area C represents future pollution problems but our concern is not to identify those that will continue to be dealt with. Area D represents existing pollution problems that will carry over into the future time period. These problems stem from existing behavior and technology, and although they represent problems that are yet to be dealt with, the methodology developed in this study

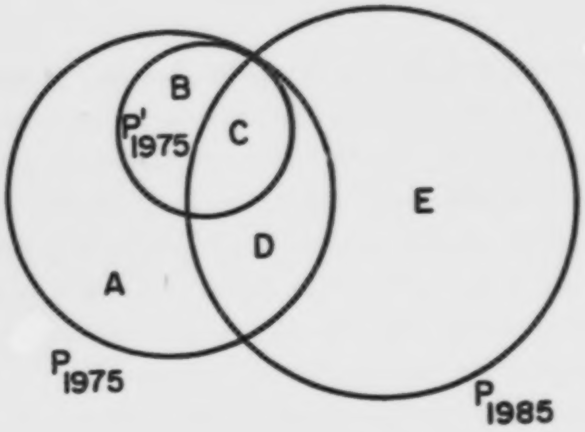

B
P'1975
C
E
D
A
P1975
P1985

FIGURE 1. RELATIONSHIP BETWEEN PRESENT AND FUTURE POLLUTION PROBLEMS

is not designed to identify these problems. Area E represents the type of future pollution problems that this study will be concerned with identifying. These are the problems that do not exist today as problems. The approach that is developed is an attempt to identify future problems that do not exist today because the technology and behavior that will generate these problems is not in existence today. However, the world of future pollution problems cannot be divided as readily as the diagram might indicate. As a result, it is quite probable that the approach that is developed will provide some indication of future problems in all three of the categories in P_{1985}.

Systematic

A systematic approach is defined as one in which another person or researcher can trace the steps and arrive at the same conclusion as the first person to apply the approach--the systematic approach implies replicability. Many approaches develop lists based on the judgment of individuals and groups of knowledgeable persons. If in a subsequent time period another (or even the same) group were to be called together, the resultant list of potential problems would probably differ from the first. Such an approach, while potentially very powerful, is not systematic.

The advantage of a systematic approach is not that it is a more powerful approach or that it would identify problems more readily than a less systematic approach, but instead that over time the approach can be refined and the data inputs can be improved, resulting in an updated set of potential problem areas that can be compared with the original set. Once the general concept is established, effort may be devoted to additional refinements in the details of the methodology. The advantage of being able to improve on the data is that as new information becomes available, it can be utilized to improve the quality of the results. Another advantage of the systematic approach is that it is possible to test the results for sensitivity to the input data. In so doing, the important data elements can be identified, and resources can be devoted to improving the quality of these data thereby improving the overall credibility of the results.

As a final advantage, the systematic approach permits others who examine the approach to find fault with it so that constructive criticism can be applied to improve the predictive power of the method. In a less systematic approach, based on individual judgment, it is not easy to identify the weak points in the approach because the selection process may be performed on an ad hoc basis by the participants using intuition and judgment.

Comprehensive

In developing an approach it is important to ensure that, because of the characteristics of the data base, most, if not all, avenues for the identification of future problems have been explored. In a historical context this is less difficult than in a futuristic context. For the historical approach one must examine and review all known possibilities for their potential for problems. In the futuristic approach, comprehensiveness is more difficult to achieve because it is very difficult to know what new or different, or presently unknown products will emerge to cause problems with their polluting characteristics. Because of the impossibility of knowing the future, the comprehensive approach should be based on examining a complete set of activities that contains all the potential for the future problems. This does not guarantee identifying future problems but it does insure that most, if not all, important indicators of future problems are considered.

The economic activity of the nation is viewed as containing all the necessary ingredients for identifying areas for future problems. Problems arise out of human activity and not out of natural environmental processes and change. The rate of change of economic activity by sector of the economy is related to the technological change and the changes in tastes and demands of the purchasers. Especially over the short run, economic activity and the changes in that activity provide the framework within which pollution problems, and more specifically future toxic substance problems are likely to arise.

There is great intuitive appeal from historical developments that indicates that pollution problems come about because of technological changes and the changes in consumptive habits of the population. For example, the deterioration of Lake Erie was attributed to chemical ingredients in soaps and from the use of agricultural chemicals. Air quality problems arise in major cities because of the proliferation of the automobile technology and the changing tastes of individuals for use of the automobile. Similarly, our demand for electrical power has resulted in further air quality problems. Also, as the change is made to nuclear fueled power plants, pollution from nuclear wastes is developing as a potential problem. In this case, the historical change in consumer tastes for electrically powered products, the technical changes permitting larger power plants for fossil fuels, and more widespread development of nuclear powered plants suggest that prediction of changes in consumptive habits and technological change would provide indicators of potential future pollution problems.

To be comprehensive in this context, the work on this project was conducted in the framework of all economic activity of man. By reviewing past economic activity, historical trends and likely future directions, products that might produce future pollution problems have been identified.

SECTION IV

METHODOLOGY REVIEW AND DEVELOPMENT

There are a large number of approaches that are currently being applied to identify pollution problems. Some of these approaches are futuristic and others depend very heavily on current statistics and information. The next section reviews some of the approaches that have been identified as being applied by agencies in the Federal government. Following the discussion of current approaches, the economics-based approach that was adopted is presented. In developing the economics-based approach for identifying future pollution problems, emphasis was placed on the identification of future toxic substance pollution problems. However, the approach developed is amenable to application to other types or categories of pollutants as might be required by different agencies of the government.

Current Approaches

A recent study by Battelle's Columbus Laboratories for EPA's Office of Toxic Substances (OTS) sought to identify and evaluate existing systems for identifying and selecting candidate chemicals or classes of chemicals with respect to their health and environmental hazards.(15) From this study it was concluded that:

- Whereas numerous systems exist which have as their objective the identification of toxic chemical substances, nearly all have been formulated within a relatively narrow framework of applicability by the user agency.
- Given a candidate list of substances of concern, three basic approaches were identified for performing the toxic or hazard assessment function necessary for ranking a prioritization of the candidates. These include the use of (1) expert opinion, (2) a numerical index or

measure of hazard, and (3) subjective weighting factors for selected parameters felt to be of importance.

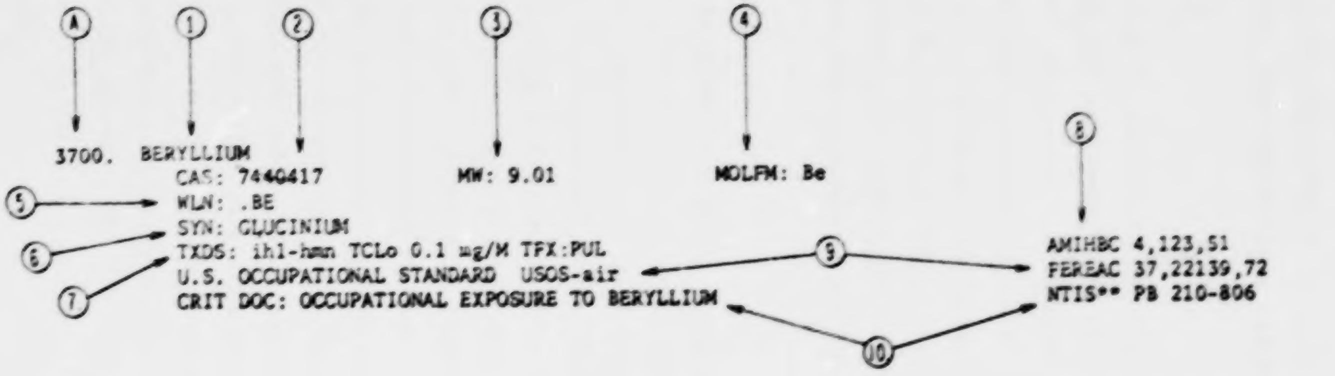
- Existing systems can be classified with respect to whether their principal function is to identify chemical substances before general exposure of the public or environment, or after such exposure occurs. None of the systems identified exhibited the systematic and comprehensive attributes deemed desirable from the viewpoint of a public regulatory agency such as OTS.

A few existing systems that have identification of toxic substances of concern as their objective are reviewed to illustrate the uniqueness of the efforts under study in this current program. Example systems can be discussed in the context of their particular sphere of development and usage, namely: occupational health, general/environmental health, and environmental management. Additional details on these examples are obtainable from the referenced OTS study report.

Occupational Health

Toxic Substance List. The best known and most widely distributed list of pure toxic substances is HEW's annual catalogue.(7) The most recent catalogue (1974) identifies 13,000 names of chemicals together with 29,000 synonymous names. Eventually it is estimated that this list will include 100,000 substances, this number representing the current estimate of the number of unique substances for which toxic effect information may be available. A chemical appearing in this catalogue has a documented, potential hazard to man and/or animals.

Criteria for inclusion of a substance included information on chemicals whose effects for man and animal were lethal, carcinogenic, teratogenic, or mutagenic, or whose effects on humans were less than lethal. The principal sources of information on individual entries are published literature, technical data from cooperating industries, and the American Chemical Society. Prioritization of substances is not performed. A typical entry with explanatory notes is presented in Figure 2. Although



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3700.  BERYLLIUM
        CAS: 7440417              MW: 9.01              MOLFM: Be
        WLN: .BE
        SYN: GLUCINIUM
        TXDS: ihl-hmn TCLo 0.1 mg/M TFX:PUL                             AMIHBC 4,123,51
        U.S. OCCUPATIONAL STANDARD  USOS-air                             FEREAC 37,22139,72
        CRIT DOC: OCCUPATIONAL EXPOSURE TO BERYLLIUM                     NTIS** PB 210-806
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A. Sequence number in this listing.
1. Prime name of compound.
2. Chemical Abstracts Registry Number, which is a number assigned to this compound so that it may be uniquely identified.
3. Molecular Weight of this compound.
4. Molecular Formula or Elemental Formula of this compound.
5. Wiswesser Line Notation, which is a formula defining the structure of this compound.
6. Synonyms, common names, trade names, and other chemical names.
7. Toxic dose line, which defines the route of administration or entry of this substance, the species involved, the type of dose reported, the dose which caused the toxic response, and the type of toxic response noted from the dose administered.
8. This is the reference to the original article or source from which the toxic data were derived.
9. U.S. Occupational Standard exists for this substance in the regulations of OSHA, U.S. Department of Labor. The standard may be found in the Federal Register referenced here.
10. A Criteria Document supporting a recommended standard has been published by NIOSH, U.S. Department of Health, Education and Welfare.

FIGURE 2. AN EXAMPLE OF A TYPICAL ENTRY IN THE TOXIC SUBSTANCES LIST, 1974

this list is prepared by HEW's National Institute of Occupational Safety and Health (NIOSH), its use by the general public will extend well beyond the occupational field.

Threshold Limit Values List. The American Conference of Governmental Hygienists (ACGIH) publishes a list of 500-600 substances for which airborne exposure levels or threshold limit values (TLV) are given. The information is intended primarily for use by industry for protecting in-plant worker exposure. Approximately 1,500 industrial hygienists serve as the source of candidate substances. Candidate substances identified by hygienists in their field work are submitted to a 15-member TLV Committee that evaluates available data on the substances and recommends both their inclusion on the list and exposure limits.

Priority List for Criteria Development. NIOSH has published "criteria documents" on a number of chemical substances and physical agents (like noise or vibration) that represent work-place hazards. Candidate substances for criteria document development are identified from a variety of sources and selected on the basis of a formalized prioritization scheme. Sources of candidate substances include past or ongoing work-place surveys and/or hazard evaluation programs conducted by NIOSH. The 1973-4 list, prepared and prioritized by NIOSH, included 471 substances. The prioritization scheme is a numerical one. The rating index is derived as the product of an "exposure estimate" and a "severity rating" for each substance. Number of workers exposed, production rates, and usage trends are considered in the "exposure estimate", whereas the severity rating is subjectively formulated using a Delphi technique with some 50 occupational health professionals. The first 10 ranked substances on the prioritized list, along with their individual numerical severity and exposure ratings are given in Table 1.

TABLE 1. TOP TEN SUBSTANCES PRIORITIZED BY NIOSH

Priority Number	Substance or Agent	Exposure Estimate	Severity Rating	Overall Rating (in 100's)
1	Benzene	2,000,000	3,000	60,000,000
2	Arsenic	1,500,000	2,000	30,000,000
3	Silica	1,200,000	1,250	15,000,000
4	Parathion (Ethyl Parathion)	250,000	4,300	10,750,000
5	Fluorides	350,000	3,000	10,500,000
6	Acetone	1,700,000	400	6,800,000
7	Acetylene	1,500,000	425	6,375,000
8	Methyl Parathion	150,000	3,000	4,500,000
9	Chromium	160,000	2,750	4,400,000
10	Nitric Oxide	350,000	1,250	4,375,000

Source: Communication with NIOSH (October, 1974).

General Environmental Health

In its efforts to gain headway against cancer, one of the leading causes of death in the U.S., the National Cancer Institute (NCI) has developed, spawned, or supported a number of systematized approaches for identifying and assessing chemical substances exhibiting carcinogenicity. One of these programs, expecially pertinent to this study, is abstracted to present the mechanisms utilized to identify and rank the candidate materials of concern.

Program on Carcinogenic Chemicals. In this NCI program, Stanford Research Institute (SRI) has devised a system to collect, analyze, systematize, and store information on carcinogenic chemicals. This information includes data on the description, production level, distribution, and the potential level of exposure that the public may experience.(21)

The process of chemical selection is as follows. First, SRI identifies chemicals within the following nine exposure categories: (1) intentional food additives, (2) pesticide residues in foods, (3) prescription drugs, (4) proprietary drugs, (5) cosmetics, (6) air pollutants, (7) water pollutants, (8) soaps and detergents, and (9) trade sales paints. After the chemicals are identified, the products containing these chemicals are identified. Then, the means of man's exposure is established as either oral, dermal, respiratory, or parenteral. An exposure factor, based upon the quantity available in commercial use and the exposure route, is calculated for each chemical. This information is then presented to NCI's Chemical Selection Committee, which selects candidates for bioassay studies.

Early in the program SRI identified 90 exposure categories believed to contain 30-50,000 chemicals. These 90 categories were subsequently reduced to the nine categories (noted above) containing perhaps 3,200 chemicals. For the nine categories 900 product types have been identified representing 18,000 chemical product combinations. The data available on these products are computerized and contain the following information.

Product - Name, quantity available for exposure, exposure routes, exposure factor by route.

Each Ingredient Chemical - Chemical Abstract Number, percent in product, degree of uncertainty associated with quantitative data, and reference to data sources.

SRI has examined the feasibility of ranking candidate chemicals with respect to the product of "exposure" and "activity (carcinogenicity)" indicators. They acknowledge, however, that there are many factors not quantifiable that dictate the selection of a chemical for testing.

Environmental Management

Manufactured Organic Chemicals. The National Science Foundation (NSF) has a program under way to identify 100 organic chemicals in commercial use that deserve high priority for research with respect to their ecological and health impacts when present in the environment in trace quantities.(31) Guidelines, developed by an NSF Advisory Panel to this study, have been specified to identifying and ranking candidates for inclusion. The approach requires the determination of "exposure" and "toxicity" factors for each candidate chemical in the initial selection step. The exposure indicator specified (called "Release Rate" by the Panel) is derived from the following equation:

$$R = (P + I)F_D + PF_{P.L.}$$

where

R = Release rate

P = Annual U.S. production of the compound

I = Annual quantity imported

F_D = Fraction of the material that goes to nondispersive uses

$F_{P.L.}$ = Fraction of the production that is lost during manufacturing, conversion, and product formulation and that escapes from the plant site.

The Committee recognized the limitations of this definition. It ignores persistency of the compound, its propensity to be transported by air and water, and its bioactivity. Nevertheless, it is to be utilized to select a preliminary listing of 250 compounds from which 100 would be selected based on further information on toxicity and other effects data.

This approach by NSF is notable in the context of this study because it is one of the few examples of an attempt to select problem substances using available economic data as a step in the screening process. The results of this effort were not available for review at the time of this report.

Alternative Methodologies Considered

Initial efforts in this project involved the development of three major alternative approaches for identifying future toxic substance pollution problems. They are

- The economics-based approach
- The toxicology-based approach
- The scientific opinion-based approach.

Each of these approaches has advantages and disadvantages that become apparent as application of the approach is developed.

The Economics-Based Approach

This approach is illustrated in Figure 3. It involves development of a method for ranking products exchanged in the marketplace for their potential for future pollution problems. In this methodology, the products are ranked and the top ranked products are further examined for their chemical (and toxic substance pollution potential) content. Toxic substance potential among the chemicals is summarized using frequency, distribution, and quantity measures. Based on this, the chemicals are ranked to form a future toxic substance list.

The number of products that will be dealt with to determine the chemical content is chosen by the user of the methodology based on the amount of resources available for detailed analysis of the chemical content of the products.

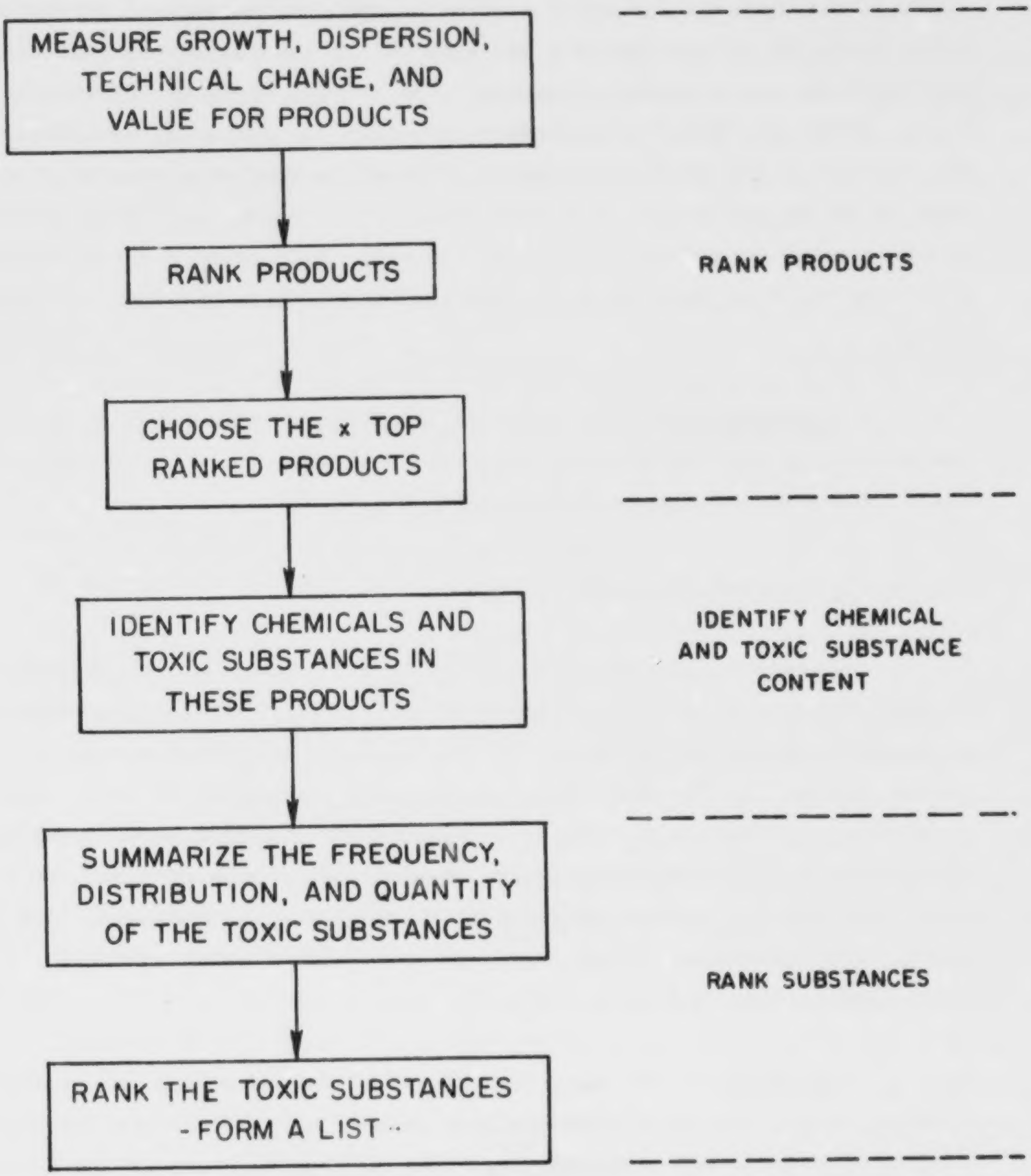
MEASURE GROWTH, DISPERSION, TECHNICAL CHANGE, AND VALUE FOR PRODUCTS
RANK PRODUCTS
CHOOSE THE x TOP RANKED PRODUCTS
IDENTIFY CHEMICALS AND TOXIC SUBSTANCES IN THESE PRODUCTS
SUMMARIZE THE FREQUENCY, DISTRIBUTION, AND QUANTITY OF THE TOXIC SUBSTANCES
RANK THE TOXIC SUBSTANCES - FORM A LIST -
RANK PRODUCTS
IDENTIFY CHEMICAL AND TOXIC SUBSTANCE CONTENT
RANK SUBSTANCES

FIGURE 3. ECONOMICS-BASED METHODOLOGY

Advantages. The major advantages of this approach are that it fulfills the criteria for being systematic and comprehensive. The futuristic characteristics of the approach are imbedded in the parameters that are developed for the economic screening. The initial steps in the methodology can be undertaken based on secondary data that are currently available. The results of the initial screening of products provide a list of products that represent potential for future pollution problems, including possible problems other than toxic substance problems. This means the results at this step could be applicable to identifying pollution problems in other media.

Disadvantages. The major disadvantage of this approach is that the transition from products to chemical constituents and subsequently toxic substances of concern is a difficult step.

The Toxicology-Based Approach

Figure 4 illustrates the steps in this approach. It is similar in many respects to the economics-based approach in that it uses sequential screening of products. However, in this approach the first screen is performed based on the potential toxicological properties of the product of concern. Subsequent screening using economic criteria permit ranking of products based on characteristics of their use in the economy. From these two steps, a list of products is obtained that is converted into constituent chemicals. These chemicals are examined using summary statistics to rank them in importance.

Advantages. The major advantages of this approach are similar to those listed for the economics-based methodology in that the approach is both systematic and comprehensive. The futuristic elements are included in the economic screening phase of the approach.

Disadvantages. The disadvantages of this approach are that the initial screening phase, based on toxicological properties of the products is very expensive to perform. Toxicological data on all products are not

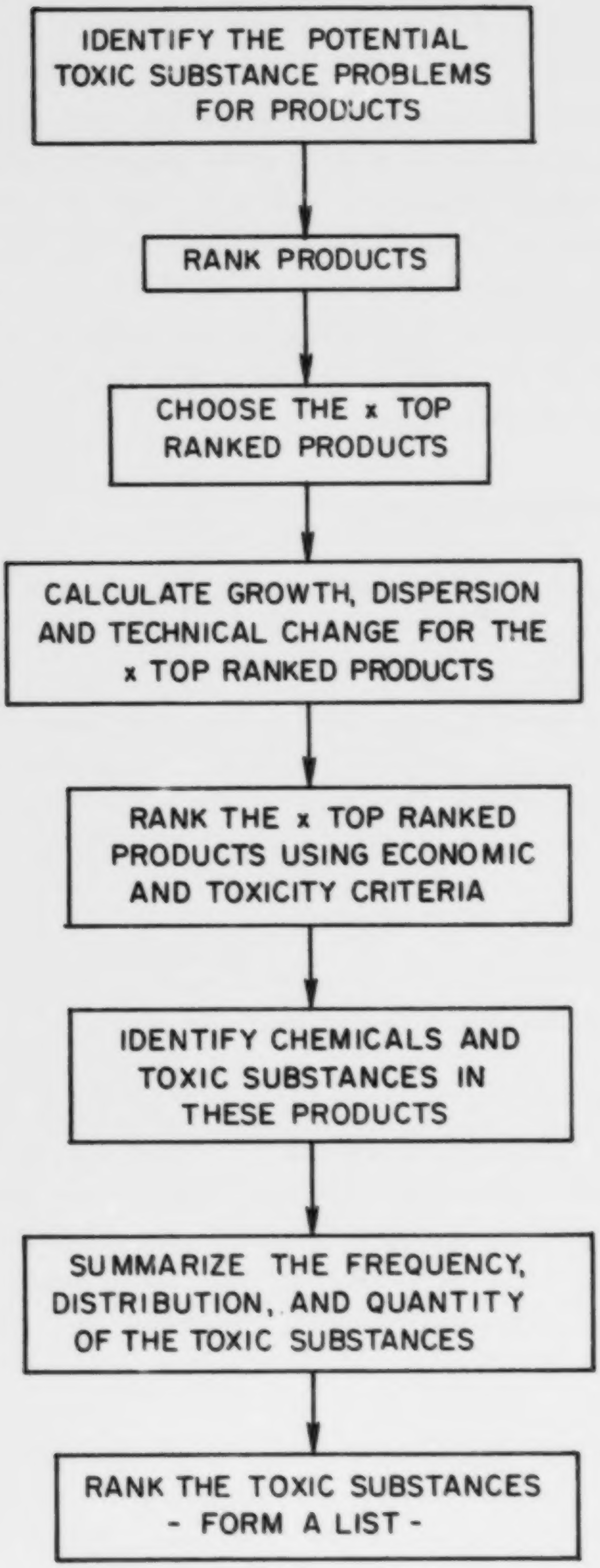
IDENTIFY THE POTENTIAL TOXIC SUBSTANCE PROBLEMS FOR PRODUCTS
RANK PRODUCTS
CHOOSE THE x TOP RANKED PRODUCTS
CALCULATE GROWTH, DISPERSION AND TECHNICAL CHANGE FOR THE x TOP RANKED PRODUCTS
RANK THE x TOP RANKED PRODUCTS USING ECONOMIC AND TOXICITY CRITERIA
IDENTIFY CHEMICALS AND TOXIC SUBSTANCES IN THESE PRODUCTS
SUMMARIZE THE FREQUENCY, DISTRIBUTION, AND QUANTITY OF THE TOXIC SUBSTANCES
RANK THE TOXIC SUBSTANCES - FORM A LIST -

FIGURE 4. METHODOLOGY BASED ON PRODUCT TOXICITY

readily available and would have to be developed for many products. In addition, a preliminary screen on toxicological properties would have to be based on known toxicity potential of products, thus the futuristic aspects of the approach would be weakened because unknown future toxic substances couldn't be identified at such an early stage. Finally, the difficulties in developing the information on the chemical content of the products that occurs in the application of the economics-based approach would apply for this approach as well.

The Scientific Opinion-Based Approach

This approach is illustrated in Figure 5. It involves the compilation of information from the literature and from expert opinion to identify a list of potential future problems. First, a rough screen is employed to identify products that might be important based on toxicity and growth characteristics. Then the literature is reviewed with respect to these products and a tentative list is compiled that indicates potential toxic substance problems. This list is used in contacts with experts knowledgeable about the products and potential associated toxic substances to determine the adequacy of the list. In this process the list might be added to or deleted from with the ultimate objective of refining the list so that it summarizes opinion regarding potential problems.

Advantages. The major advantage of this approach is that it provides a method for obtaining a reasonably workable list quickly. The list may turn up fairly obscure problems that might become quite important over time. It provides a method to collect and summarize expert knowledge and opinion regarding potential future toxic substances. The activities may be undertaken in direct proportion to the availability of resources.

Disadvantages. The major disadvantage of this approach is that it duplicates activities that have been or are currently being done by other agencies in identifying substances of concern. Furthermore, the

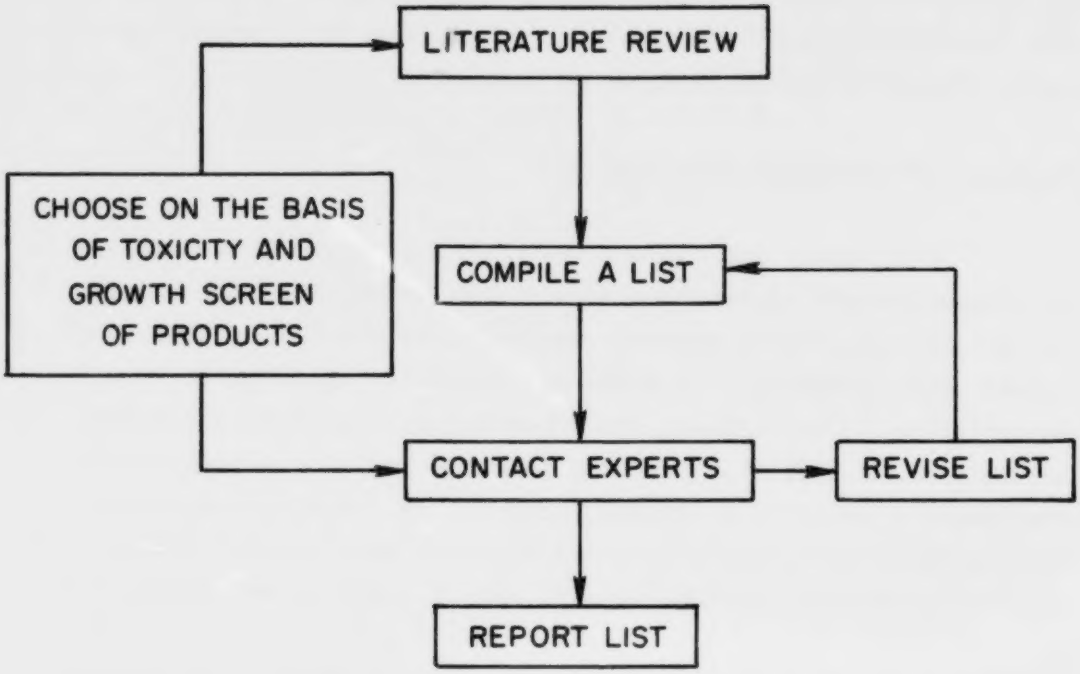
LITERATURE REVIEW
CHOOSE ON THE BASIS OF TOXICITY AND GROWTH SCREEN OF PRODUCTS
COMPILE A LIST
CONTACT EXPERTS
REVISE LIST
REPORT LIST

FIGURE 5. APPROACH INVOLVING USE OF EXPERT OPINION AND OTHER INFORMATION

approach is not systematic and is not comprehensive. A different set of experts might identify a completely different set of problems. After applying the approach, one cannot assert that all activities of man have been considered in the review process. If there is no literature or no expert contacted, then the area would be missed.

Choice of the Economics-Based Approach

Preliminary steps were taken in each of these approaches, but the economics-based approach was adopted for most detailed development. For the toxicology-based approach, the high cost involved in the initial toxicological screening of products was the factor that reduced it in desirability. At an interim project meeting with the Project Officer, the decision was made that remaining resources would be devoted to the development of the economics-based approach. The scientific opinion-based approach was pursued in a preliminary way only because various agencies are already actively pursuing this approach or one similar to it.

Preliminary screening of manufacturing sectors of the economy was performed to select Chemicals and Allied Products as a group of SIC's that warrant additional attention, based on potential for future toxic substance pollution problems. Because significant cost would be involved in continuing this approach in greater detail, the development of the toxicological approach stopped with the completion of this step. The results were used, however, to narrow the scope of inquiry in the application of the economics-based approach.

The Economics-Based Methodology

The economics-based approach is designed to be a futuristic, systematic, and comprehensive approach for identifying potential future pollution problems. The futuristic aspect of the approach is introduced through information on trends in historical growth of economic production, projections of future growth and projections of future technical change.

The approach is systematic because all steps in the application of the methodology are replicable. The comprehensiveness of the approach is embodied in the fact that it is designed to consider all of man's economic activity.

Economic activity is chosen as the basis for the methodology because virtually all exposure to pollutants results from the production, exchange, and consumption of goods and services. The exposure that occurs as a result of waste material disposal (residuals) is accounted for in this approach through including factors on technological change and dispersion of product. The economics-based approach deals with exposure implicitly through both the dispersion factor and value of product. However, an explicit analysis of exposure could be useful in the ranking of chemicals as constituents of products. The work being done by SRI for NCI suggests four areas where exposure may occur

- Environmental
- Household
- Avocational
- Occupational.(29)

Alternatively, opportunities for exposure might be classified on the basis of activities such as

- Home living
- Transportation to work
- The work environment
- Recreation and other activities.

It is important to identify the type, level, or duration of exposure that occurs for a given product. While this information is important in ranking products for consideration, the costs of obtaining the specific information for each product are prohibitive. Exposure may also be important in ranking specific chemicals that are identified as potential problem chemicals. However, some aspects of exposure will depend on the characteristics of the chemical itself. Because of the high costs involved, an explicit consideration of exposure should await preliminary economic screening of products and chemicals. Having chosen a list of high priority items for consideration, detailed exposure analysis could be used to further screen the candidates on the list.

The Use of Input-Output

The development of the economics-based approach is predicated on the assumption that information regarding future toxic substance pollution problems can be obtained from data on the production, exchange, and consumption of goods and services. All of these factors are embodied in an input-output model of the U.S. economy that projects into future time periods.

Composition and magnitude of future pollution and/or toxic substance generation is a function of two forces acting on the U.S. and world economies:

- Technological change in industrial processes and products
- Shift in consumption patterns.

Changing production and product technology is the largest contributing factor to generation of direct and indirect toxic substances.(8) Technological change occurs in a variety of ways including:

- Development of more "efficient" capital stock (equipment, machines, vehicles) that produces greater value of services per unit of input
- Development of more "efficient" production processes that result in increased output per unit of labor and materials input
- Development of new materials lowering the labor or material costs component of production (plastics replacing wood in some uses, drywall replacing plaster, etc.)
- Development of new consumer products (aerosol hairsprays replacing hair oils).

The generation of direct and indirect toxic substances due to shifts in consumption patterns probably cannot be analyzed separately from changing product composition. Changing consumer tastes and preferences may be an independent force inducing corporations to develop new products and production technologies, but there is considerable professional controversy over the role and extent of consumer sovereignty in the American economic systems.(17) For purposes of this analysis, no attempt is made to develop an independent methodology for predicting future composition of consumption.*

The methodology focuses on using the relationship between technical change in production and products on the one hand and generation/dispersion of toxic substances through products on the other to identify potential products of concern.

Technical Considerations

Analysis of future toxic substances generation requires a systematic procedure for dealing with the highly complex interrelatedness of the American economy. Traditional input-output analysis offers a practical framework for accomplishing this analysis. Statistical input-output analysis measures the value flows between producers of output on the one hand and input users and final consumers on the other. For an n-industry economy the interindustry coefficients are arranged as a matrix.

$$A = [a_{ij}]$$

where a is a matrix element representing sales from sector i to sector j expressed as a fraction of the output from sector j.

In addition to the requirements of the n-industries for inputs, there is also a final demand sector. Thus, if industry i is to produce output sufficient to meet input requirements of all other industries as well as final demand, its total output (x_1) is specified by the following equation.

$$x_1 = a_{11}x_1 + a_{12}x_2 + \ldots\ldots\ a_{1n}x_n + d_1 \qquad (1)$$

where d_1 is the final demand for the output of Industry 1. The equation can be rewritten as

$$(1 - a_{11})x_1 - a_{12}x_2 - \ldots\ldots\ a_{1n}x_n = d_1 \qquad (2)$$

For the system of n-industry equations, this would be

$$(I - A)x = d \qquad (3)$$

---

* Projection of future consumption patterns have been attempted and can be employed.(22)

where

I = nxn identity matrix
A = nxn coefficients matrix
x = nx1 industry output vector
d = nx1 vector of final demands

If (I - A) is nonsingular, a solution to (3) exists represented by

$$x = (I - A)^{-1}d \tag{4}$$

where $(I - A)^{-1}$ is termed the inverse matrix and contains coefficients that reflect the direct and indirect requirements for each industry to produce one dollar's worth of final output. This matrix is highly useful since it is possible to premultiply any final demand vector by the inverse to produce a new solution vector for industry outputs. The information imbedded in the matrix is utilized for the systematic assessment of the implications of technical change on the generation of future pollution problems. It is also used in measuring the dispersion of sectoral output through the economy.

The interindustry coefficients matrix, under certain limiting assumptions and statistical provisions, represents the present "technical structure" of the economy. That is, the present relative input requirements at present prices for each output are depicted by the coefficients. Because the economy and the factors that affect the economy do not remain static, the statistical coefficients change over time. Part of the change in coefficients represents real technical change in input-output relationships. However, the coefficients also include prices because the requirements are expressed in terms of present prices.

The conceptual basis for using an input-output model to analyze potential development of future toxic substance problems is based on four factors that can potentially generate future toxic substance problems. The factors that can, in theory, be examined using the input-output framework are:

- Introduction of new technologies or materials in the production processes causing a change in the interindustry coefficients matrix designated as A

- Diffusion of new technologies or new materials across a greater number of industries
- Growth in final demand assuming present composition (designated as d)
- Change in composition of final demand as well as growth (designated as d').

Thus by changing the technical coefficients and the level or composition of final demand (or both) the input-output structure can be used to portray changing economic conditions. Correlation of toxic substance problems with changed economic structure can be accomplished in one of two ways. The most rigorous approach would be that proposed by Leontief in which "residuals" from each industrial sector are included in the model.(27) Net residuals represent the degree of treatment of effluents provided in each sector. Untreated residuals are depicted as accruing to final demand. Data requirements for this approach, unfortunately, limit its immediate usefulness for the problem at hand. In addition, identification of residuals presupposes knowledge of a problem whereas this project is to identify the potential problem. What is desired is an approach that uses available data to show points in the economic system at which toxic substance problems may emerge.

Steps in the Methodology

The methodology that is developed is specifically directed toward identification of product categories that warrant special attention because of growth, dispersion, technical change, or value of shipments factors. Having ranked products according to these factors, the complete application of the methodology requires the identification of specific product characteristics that indicate whether or not the product has potential toxic substance pollution properties. In particular, the chemical make-up of the product must be identified and potential toxic substances among these should be identified.

The initial step in the methodology, the economic screening, does not specifically address toxic substances but the application of criteria related to potential toxicity for products in various SIC's is performed to narrow the list of products and associated chemicals considered.

Product Ranking. There are a variety of information sources that provide insight regarding what products should be of concern. Census data, labor statistics, and professional opinion in various forms all contribute to identifying high priority products. The economics-based methodology combines this information for a given product in such a way as to permit products to be ranked in order of importance. Therefore, there is associated with any product, p, information on growth, dispersion, technological change, and quantity. The rank of the product in terms of its potential for future pollution problems based on economic criteria, R_p, depends on these factors.

$R_p = f(d,g,t,v)$
d = dispersion
g = growth
t = technical change
v = value of product.

The data used to prepare indices for all factors are available in various levels of completeness and detail. However, all information collected is related to the Standard Industrial Classification (SIC) of products. Value of shipments data are collected on a product-by-product basis. Growth data are available both at the product code level and at the 3- or 4-digit SIC levels. Dispersion and technological change data are collected and used at the 3- and 4-digit SIC levels. Some information on dispersion, for example, is available only at the 2-digit level. Therefore, these data apply to all products that have those 2 digits as the first two in the product code.

In ranking products for their relative importance as contributing to potential future pollution problems, data on the selected criteria must be combined. Growth data are obtained on the basis of annual percentages, dispersion data are calculated as an index, technical change data are calculated as an index, and value of product data are collected in dollars per year. These factors are not defined in commensurate units. A simple method for converting these data to common units was applied. For example, growth rates ranging from -20 to +30 percent per year are converted to a

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* Value of shipments data are reported in Appendix B.

scale that ranges from 0.00 to 1.0. Similarly, value, technical change, and dispersion are also converted to a similar scale.

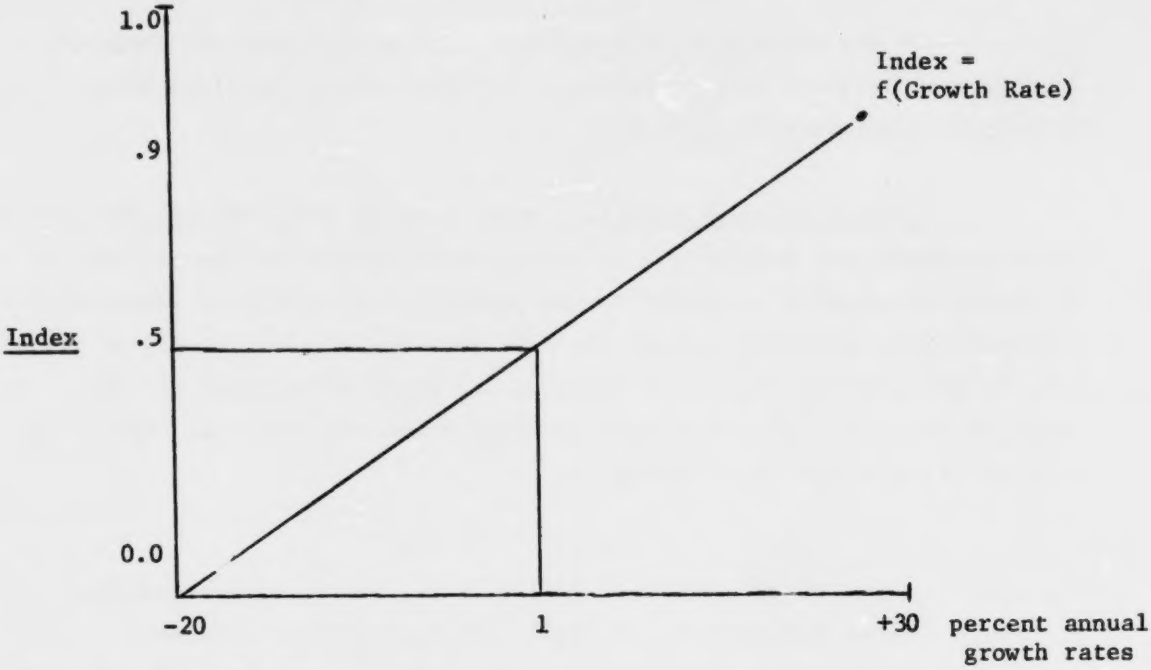

FIGURE 6. METHOD FOR THE CONVERSION OF FACTORS TO COMMON UNITS

From Figure 6 a growth rate of 1 percent per year is converted to 0.5 in the index. In this manner, the growth rate, g, would be converted to an index, I_g, that has the same range as the index for dispersion, technological change, and value. Thus:

$$R_p = h'(I_g, I_d, I_t, I_v).$$

The rank of the product is determined as a function of the indices. The growth factor was expanded to incorporate both historical growth and future growth, primarily because the sources of data for these two elements were different. Thus, the final formulation as applied for product ranking is:

$$R_p = h(I_g^h, I_g^f, I_d, I_t, I_v).$$

The relative importance of each factor in the ranking procedure was taken into account in calculating the ranking. The ranking of the products is calculated according to the following formula:

$$R_p = \alpha_1 I_g^h + \alpha_2 I_g^f + \alpha_3 I_d + \alpha_4 I_t + \alpha_5 I_v.$$

where the α's are determined judgmentally.* The method that was employed to establish relative importance was a modified Delphi technique using selected project participants.

Chemical Content Analysis. After ranking the products, the methodology requires that information on the chemical content of the products be collected for a group of higher ranked products. This type of information is available from secondary sources for some products but not for all of them.** Data on the chemical content of the products would be examined for the types of chemicals that could lead to toxic substance problems. Thus, the product, p, is composed of chemicals:

$$C_p = [\ C_1, C_2, C_3, \ldots\ldots\ C_n],$$

but only a subset of all chemicals is likely to lead to toxic substance problems. Others may lead to air, water, or land-related pollution problems; however, toxic substance-related chemicals are the important ones for this study.

Chemical Substance Ranking. Each product is ranked according to economic criteria and, for selected products, information on associated toxic substance-related chemicals is obtained. If this analysis were completed for all products, toxic substance problems would be identified by examining a matrix that lists ranked products on one axis and chemicals*** on the other:

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* To remove judgment completely is impossible but the method for recording and synthesizing judgment is made explicit. In addition, it may be possible to estimate these coefficients statistically, but this was not attempted in this research.

** See page 75 which discusses our findings on the availability of chemical constituent data.

*** It may be useful to reduce the list of chemicals by dealing only with "toxic substance-related" chemicals. However, this definition is difficult to implement in screening chemicals. Thus, if the list of products is small enough, all chemicals could be included in the matrix. The analysis of chemical components of SIC 2844 (see Table 12, pp 76,77) suggests that the large number of chemicals in products may make this a very costly task.

P = all products

$P = [\, P_1, P_2, P_3, \ldots\ldots P_m \,]$ for m products

C = all chemicals

$C = [\, C_1, C_2, C_3, \ldots\ldots C_n \,]$ for n chemicals.

In the matrix in Figure 7, t_{mn}, is the quantity of the n^{th} potential toxic substance used in the m^{th} product. The total volume of the chemical, V_n, is $\sum_m t_{mn}$. Frequency, f_n, is the number of products containing chemical C_n. In addition to the total volume and frequency of occurrence of t_{mn} in C_n, a coefficient of dispersion of chemicals, d_n, could be calculated, using a procedure similar to that employed in calculating dispersion for the products.

Let $\nu_{mn} = \dfrac{t_{mn}}{\sum_m t_{mn}}$ (the fraction t_{mn} is of the total, $\sum_m t_{mn}$)

and $d_n = \sum_m \nu_{mn} \log \nu_{mn}$

This would be interpreted such that for C_n and C_{n+k} if $d_n < d_{n+k}$, C_{n+k} would be a more widely dispersed chemical among products considered. Based on its dispersion characteristics, other things being equal, it would warrant greater attention as a possible future toxic substance pollutant.

Such summary statistics of the chemicals in the matrix would provide a basis for identifying those chemicals that are likely to lead to future toxic substance pollution problems. The comparison of C's on the basis of the frequency of occurrence among products, dispersion among products, and/or on the basis of a volume statistic could be performed to calculate a comprehensive ranked list of all relevant chemicals. The ranking in this framework would produce an ordered list of chemicals for consideration as future toxic substance problems, R_t,

$$R_t = \phi(V_n, f_n, d_n).$$

where

R_t = rank of chemical

V_n = volume of chemical

f_n = frequency of occurrence of chemical in matrix

d_n = dispersion of chemical in the matrix.

$$\begin{array}{l|ccccc}
 & \multicolumn{5}{c}{\text{Chemicals}} \\
\text{Products} & C_1 & C_2 & C_3 & \cdots\cdots & C_n \\ \hline
P_1 & t_{11} & t_{12} & t_{13} & \cdots\cdots & t_{1n} \\
P_2 & t_{21} & t_{22} & t_{23} & & \cdot \\
P_3 & t_{31} & t_{32} & t_{33} & & \cdot \\
\cdot & \cdot & & & & \cdot \\
\cdot & \cdot & & & & \cdot \\
\cdot & \cdot & & & & \cdot \\
\cdot & \cdot & & & & \cdot \\
P_m & t_{m1} & \cdots & \cdots & \cdots\cdots & t_{mn} \\ \hline
\text{Total} & V_1 & & & & V_n \\
\text{Frequency} & f_1 & & & & f_n \\
\text{Dispersion} & d_1 & & & & d_n
\end{array}$$

where t_{11} = quantity of C_1 used in product P_1 (for many cells, t may take on a value of zero)

$V_n = \sum_m t_{mn}$ (total quantity)

f_n = frequency

d_n = dispersion

FIGURE 7. MATRIX FOR EVALUATING THE INCIDENCE OF CHEMICAL SUBSTANCES IN PRODUCTS

The results of the full application of the methodology would provide an ordered list of chemical substances of concern.

The methodology was applied and demonstrated on a limited basis. From Figure 3 it may be seen that the major steps in the application of the methodology are:

(1) Rank products according to growth, dispersion, technical change, and value criteria

(2) Identify chemical and toxic substance content of high ranked products

(3) Rank substances on the basis of frequency, distribution, and quantity.

Step (1) has been performed for all Chemical and Allied Products (SIC 28). Step (2) has been done for Toilet Preparations (SIC 2844), and the possibility of performing Step (3) is indicated by the list of chemicals for SIC 2844 but the actual construction of the matrix to perform this task would require considerable resources, beyond the scope of this contract.

Data Requirements

In the application of the economics-based approach, a substantial amount of economic data are collected and summarized in the various parameters that comprise the ranking of the products. A comprehensive catalog of economic data for the economy, developed for a broad range of activity, helps improve comparability among parameters and between products reviewed. However, no uniform, consistent data base was identified that could be used for this study. Thus, the data are developed from general sources.

The two major data collection phases of the research necessary to implement the economics-based methodology are

- The collection of economic data related to the products
- The collection of chemical content data related to the products.

Activities that demonstrate the feasibility of both of these phases were undertaken. The collection of data for the economic screening of products and the organization of the data for performing the product ranking embodied a large portion of the effort on this project. A lesser level of effort was devoted to determining whether or not it is feasible to collect and systematize data on the chemical content of various products. Less emphasis was placed on this phase for two reasons. First, it became clear that although it is possible to identify the chemical components of a product, the cost of this identification process might be quite high for some products. Second, the preliminary results of the project that is being done for NCI and work on the chemical content of water-polluting products by EPA indicate that identification of chemical (and thus toxic substance) content of a product is feasible.(13,29)

Because there is a large amount of economic data that might be relevant to the question of whether or not a product has the potential for future toxic substance pollution problems, it was necessary to develop a method for collecting and summarizing the data to provide a ranking of products. To do this, data on the subject parameters were collected and indices were developed for each one. These indices were combined, using a weighting method to form a composite index that ranks products for their potential for future pollution problems. There are two primary sources of data, the U.S. Census of Manufactures and input-output models of the United States' economy. The input-output models that were used were a 127-sector model developed by Battelle as part of the PREVIEWS 85 program (see Appendix A for a brief overview of the PREVIEWS 85 model) and the 1967 OBE table).(36) The PREVIEWS model is used to project input-output relationships into future time periods and the OBE table was used initially to develop dispersion indices. The approach developed for ranking products could use the results of any input-output model that produces, as output, the technical coefficients for future time periods, although the credibility of the results depends on the quality of the coefficients.*

The Census of Manufactures data are used to estimate historical growth by product. From this estimate the index of historical growth is calculated. The value of shipments is used as a measure of the quantity of product that is exchanged and Census of Manufactures data are used for developing the index based on this data also.

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* These models were used in this analysis for convenience only and were not evaluated for credibility. In general, however, the exante approach for estimating coefficients used in the PREVIEWS model is more futuristic than the statistical approach of the OBE model.

SECTION V

CRITERIA PRODUCT RANKING

The separate ranking of products is important in this methodology because, recognizing limitation on resources, the agency concerned about future pollution problems must begin somewhere. With a product ranking, research can be prioritized and the scope of inquiry narrowed to a subset of the total list of 5,000 products depending on the availability of resources for obtaining more detailed product related data on chemical make-up and (perhaps) exposure.

Full application of the economic-based approach would identify toxic chemical problems based on historical data, projections based on historical changes, projections of future conditions based on expert opinion, and information on the chemical content of products. The major factor limiting the full application of the methodology is resources. However, in this project the approach is applied at a reduced level of effort to demonstrate the methodology by undertaking steps that limit the scope of the analysis.

- The number of products considered is reduced by preliminary screening on the basis of "potential" for future toxic substance pollution problems.
- The number of products for which specific chemical content data and potential toxic substance data are collected was reduced by choosing to collect the data for a limited group of products.

To utilize the economic methodology described in identifying potential future toxic substances it was necessary to select a sector of the economy that would contain activities in which physical input and/or output might contain these substances.

Based on a preliminary screening of 4-digit SIC's the application of the methodology was limited to Chemicals and Allied Products (SIC 28). The results of the preliminary screening are presented in Table 2. In this

TABLE 2. RANKING OF 4-DIGIT SIC'S IN EACH SECTOR (2-DIGIT SIC'S)

Sector*	No. of 4-digits	No. Ranked 1's	No. Ranked 2's	No. Ranked 3's
20	45	1	30	14
21	4	2	2	0
22	32	3	29	0
23	32	0	32	0
24	11	0	5	6
25	11	0	0	11
26	16	2	13	1
27	15	0	9	6
28	27	19	8	0
29	5	5	0	0
30	5	1	3	1
31	10	1	0	9
32	26	8	14	4
33	24	6	18	0
34	27	3	1	23
35	39	0	2	37
36	34	2	3	29
37	16	0	2	14
38	4	0	0	4
39	21	0	8	13
	404	53	179	172

* Each 2-digit SIC is an economic sector.

Source: Battelle ranking.

procedure a number 1 ranking indicated that the SIC was highly likely to contain products that would cause future toxic substance pollution problems. A ranking of 3 indicates that the SIC is unlikely to contain products with future toxic substance pollution problems. If the SIC lay somewhere between these two classes it was assigned a rank of 2. Table 2 shows the number of 4-digit SIC's that are contained in each 2-digit SIC for each rank. From these results Sector 28 was chosen for more detailed study.

Chemical constituents by product were examined for Toilet Preparations (SIC 2844).* Results of this work are presented in the next section.

After reducing the scope to manageable size, it was possible to utilize data on an industry and, more specifically, product level to develop a systematic "economic" screening process to produce a ranked list of products and industries. These could be used as further input into a toxicological screening process and analyzed for potential toxicity. The Standard Industrial Classification (SIC) system, as employed in the economic Census of Manufactures, was used as the basis for industry and product identification. Overall, there are approximately 420 4-digit (19-39) containing several thousand 7-digit products. Within SIC 28 there are 760 products that must be ranked. Because of the large number of products and industries, and to facilitate the screening process, a computer program was developed to rank the products.

Ranking is a function of various parameters. These are historical growth, dispersion, technical change, future growth, and value of shipments related to the subject product. These factors were combined in a formula by normalizing the various types of data on these variables, thus converting them into common units, then applying a weighting factor, and finally summing the factors times their weights to produce a composite index indicating the potential importance of a product. The weights that were used to rank products are:

- Historical growth - 2.90
- Future growth - 2.43

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* This SIC was chosen as an example with products likely to have a large number of chemical constituents.

- Dispersion - 2.36
- Technical change - 1.35
- Value of product - 1.13.

The purpose of this section is to discuss in detail each of the parameters that are utilized in the economic methodology.

Historical Growth

By comparing the quantitative changes in growth from year to year in output data related to a product, it is possible to observe how much the output of a particular product has changed over time. For the purposes of this study, however, the rate of growth of production indicating how fast production growth is occurring is of greater significance than the amount of growth. When the composite ranking index is compiled, the growth rates of subject products are one factor considered. Fast-growth products or groups of products within an industry are more likely to cause future pollution problems than those of declining or relatively slower growth. Furthermore, the rate of growth also indicates the need for new productive capacity and this may be associated with technological change.

The computerized product growth rate calculations for the economic methodology were performed historically for a 14-year time span. Using the Census of Manufactures Industry Statistics for 1958, 1963, 1967, and 1972 as a data base, rate of growth calculations were completed for 28 4-digit industries in the SIC major group 28, Chemicals and Allied Products. They are the following:

2812 Alkalies and Chlorine
2813 Industrial Gases
2815 Cyclic Crudes and Intermediates
2816 Inorganic Pigments
2819 Industrial Inorganic Chemicals
2821 Plastics Materials and Resins
2822 Synthetic Rubber
2843 Surface Active and Finishing Agents
2844 Toilet Preparations
2851 Paints and Allied Products
2861 Gum and Wood Chemicals
2869 Industrial Organic Chemicals, N.E.C.
2873 Nitrogenous Fertilizers
2874 Phosphatic Fertilizers

2823 Cellulosic Man-Made Fibers
2824 Organic Fibers, Noncellulosic
2831 Biological Products
2833 Medicinals and Botanicals
2834 Pharmaceutical Preparations
2841 Soap and Other Detergents
2842 Polishes and Sanitation Goods
2875 Fertilizers, Mixing Only
2879 Agricultural Chemicals, N.E.C.
2891 Adhesives and Sealants
2892 Explosives
2893 Printing Ink
2895 Carbon Black
2899 Chemical Preparations, N.E.C.

Data Base

For each of these 28 industries various types of data have been collected and published by the Census of Manufactures. Among these are data on manufacturing establishments relating to value added by manufacturing expenditures, inventories, and value and quantity of products shipped. To derive rates of growth for each specific group of related products, value of products shipped was used.

Value of shipments (i.e., value of products) is reported using the establishment as the reporting unit and is based on net selling value, FOB plant, after discount and allowances and excluding freight charges and excise taxes. In addition, manufacturers report receipts for contract work performed for others, resale, receipts for miscellaneous activities such as sale of scrap or refuse, and the value of installation and repair work performed by the plant employees. Multiestablishment companies are asked to report value information for each establishment as if it were a separate economic unit. They are instructed to report the value of all products transferred to other plants of the company at their full economic value, that is, to include a reasonable proportion of company overhead and profits.

Value of shipments information was typically available for all the products in the sample except in cases where the figures of individual companies were withheld, by law, to avoid disclosure. It was not available if the collection of value figures was not applicable in a particular instance, or the value was less than 0.1 million dollars when rounded.

Typically, classification of establishments for which data are tabulated in the Census of Manufactures is determined by current definitions and coding structures in the Standard Industrial Classification manual.(41) However, from one census to the next the code numbers may be changed and/or there may be changes in the content of an industry in comparison with data from the previous classification. For example, 1972 SIC 2869, Industrial Organic Chemicals, N.E.C., was under code number 2818 in 1967. Similarly, in 1972, Agricultural Chemicals, N.E.C., contained Household Insecticides and Repellents, including Industrial Exterminants, which were previously found in SIC 2842, Polishes and Sanitation Goods.

These changes, however, were not major problems in the data collection for the ranking program. Fortunately, the Census of Manufactures provides bridge tables that explain the reorganization of what constitutes a given code classification.

Nevertheless, there were some constraints in establishing the data base. These constraints were generally of three types of which the major ramification was the occasional forfeit of data for a certain year, leaving the ranking to only 9 years, or 5, or 4. The first constraint was unavailability of data for any given year for a particular product. The circumstances for these deletions were previously mentioned, but to reiterate, they were (1) figures withheld to avoid disclosure (D), (2) not applicable (X), (3) not available (NA), and (4) less than 0.1 million dollars when rounded (-). For example,

1972	1967	1963	1958
25.0	19.0	(X)	(NA)

Second, because the Census of Manufactures has been refining its industry classifications and providing greater detail in current years, the definition of an earlier classification may contain several products while in the classification of the following census these products may each have its own classification. Thus, the product codes may not be comparable among years. To remedy this situation, it was necessary to combine the value of shipment amounts for the newly segregated industries to make them once again comparable within their original grouping. This was done, however, at the expense of the useful individual product detail.

Third, a combination of the first and second, was the case of having to delete 1 year due to incomparable definitions of categories.

After the data base was collected and a coding format was prepared, data cards were keypunched and readied for computation. The cards contain the following information:

(1) Product code number

(2) SH (indicating that shipments information was used)

(3) For how many years data were available, i.e., 1, 2, 3, 4 (1958, 1963, 1967, 1972)

(4) Unit of measure of quantity of shipments (to be discussed separately) or label (always million dollars) for value of shipments

(5) Year of data

(6) Quantity of shipments

(7) Value of shipments*

Rate of Growth Calculation

The computer subprogram for rate of growth was executed specifically on value of shipments data. The following formula was used to calculate rate of growth:

$$X_t = X_o (1 + r)^t$$

where

r = rate of growth per time period

t = number of years

X_o = value of shipments at $t=0$, or base year

X_t = value of shipments after 7 years.

For example, given values of 1958, 1963, 1967, and 1972 growth rates were calculated for each time period between the years for which there were data, beginning the process with the earliest available year as the base year. Finally, the total growth rate, describing the period from the original base year to the most current year, was computed.* This total growth rate can be used to rank the products within an industry, with the fastest growing products heading the list.

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* Growth rate estimates based on value of shipments is biased because of the potential for differential growth rates for pieces of the products. Data to normalize for price changes did not exist but if available could be used to adjust value of shipments data to hold relative prices constant.

The resulting computer output for application of the rate of growth subroutine for Medicinals and Botanicals (SIC 2833) is presented in Table 3.** The table is an optional output of the ranking program.

Table 4 is a list of product codes and their definitions for SIC 2833. The definitions of products in industry 2833 are consistent with those offered in the Census report; however, as mentioned previously, some rearranging was necessary in defining products of other industries within major group 28, to render data comparable from year to year.

The 1958 value of shipments data for SIC 2833 is not included in Table 6. This is because in 1958 collection of these data were classified "not applicable" by the Census of Manufactures and thus, not reported. However, the computer program is equipped to adjust to this deletion and computes rate of growth statistics for the remaining 9-year period.

The results show that product code 29332 61, Other Organic Medicinal Chemicals, was the fastest growing product within the industry Medicinals and Botanicals.

The total growth rate from base year 1963 when value of shipments of products was 14.5 million dollars to 1972 when value of shipments of products climbed to 53.1 million dollars was 17.75 percent per annum. The growth rate was the most rapid between 1963 and 1967 at 22.26 percent per annum and although the monetary value shipments continued to increase between

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* Although the total growth rate was used in ranking, it is useful in the comparison of high ranked products to know which was growing most rapidly in the most recent time period. Therefore, the intermediate growth rates are also calculated.

** The Medicinals and Botanicals Industry, as defined by the Census of Manufacturers, "includes establishments primarily engaged in (1) manufacturing bulk organic and inorganic chemicals and their derivatives and (2) processing (grading, grinding, and milling) bulk botanical drugs and herbs. This industry also includes establishments primarily engaged in manufacturing agar-agar and similar products of natural origin, and endocrine products; manufacturing or isolating basic vitamins; and isolating active medicinal principals such as alkaloids from botanical drugs and herbs".

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TABLE 3. VALUE OF SHIPMENTS OF PRODUCTS FOR SIC 2833

1972 PRODUCT CODE	UNIT OF MEASURE	TOTAL GROWTH RATE	1972 VALUE (MIL $)	GROWTH RATE	1967 VALUE (MIL $)	GROWTH RATE	1963 VALUE (MIL $)	GROWTH RATE	1958 VALUE (MIL $)
28332 51	MILLION DOL	.177[illegible]	63.1	.1425	32.4	.2225	14.5		
28332 11	MILLION DOL	.1[illegible]	23.0	.3313	5.5	-.0132	5.8		
28332 21	MILLION DOL	.1021	29.5	.2203	10.9	-.0298	12.3		
28332 --	MILLION DOL	.0[illegible]	141.2	.1201	80.1	.0546	64.7		
28331 10	MILLION DOL	.0776	250.2	.0545	191.6	.1063	127.7		
28331 --	MILLION DOL	.0[illegible]	629.7	.0457	503.7	.0818	367.8		
28331 20	MILLION DOL	.0021	379.6	.0399	312.1	.0677	240.2		
28332 00	MILLION DOL	-.0057	1.6	.0778	1.1	-.1031	1.7		
28332 41	MILLION DOL	-.0213	7.5	-.0400	9.2	.0027	9.1		
28332 13	MILLION DOL	-.0235	16.4	-.0482	21.0	-.0035	21.3		

Source: Battelle program output.

TABLE 4. PRODUCT NAMES FOR SIC 2833

Product Code	Product Name
28331 --	Synthetic Organic Medicinal Chemicals, in bulk
28331 10	Antibiotics, including all such uses as veterinary food supplements, food preservation, crop spraying, etc., but excluding antibiotic preparations
28331 20	Other Synthetic Organic Medicinal Chemicals, except antibiotics
28332 --	Other Medicinal Chemicals and Botanical Products, in bulk, N.E.C.
28332 13	Botanical Drugs
28332 21	Naturally-Occurring Vitamins (from yeast, plants, fish, liver, etc.)
28332 41	Drugs of Animal Origin, including dried glands and other animal organs and tissues and extractions thereof
28332 61	Other Organic Medicinal Chemicals
28332 81	Inorganic Medicinal Chemicals
28332 99	Other Medicinal Chemicals and Botanical Products, in bulk, N.E.C., n.s.k.

N.E.C. - Not elsewhere classified.

n.s.k. - Not specified by kind.

Source: U.S. Department of Commerce, Bureau of the Census, Census of Manufactures, Industry Series, Preliminary Report (1972).

1967 and 1972, the growth rate declined. Although activity may have declined within the most current period of time, product code 28332 61 had the highest overall growth rate relative to the other products in the industry.

Table 5 presents an overall ranking based on historical growth rates for all products in Chemical and Allied Products sector of the economy. These are the top 25 products ranked by annual growth rate. Appendix C contains a complete listing of historical growth of value of shipments for all Chemical and Allied Products.

Future Growth

Although the historical growth of a product and its use is an important factor in identifying those products that are likely to cause problems in the future, ideally, one would use future growth of the product. Unfortunately, we do not have observations of the future growth of a product, but instead only have projections of possible future growth that is based on certain assumptions and information that indicate possible future events. Therefore, although future growth is an ideal measure to indicate the importance of a product, our information on future growth as a parameter must be conditioned by the uncertainty involved in making such estimates.

The rationale for including future growth as an important factor is that most of the future pollution problems will probably come about as a result of a change in the quantity or quality of products. Problems that are known or that exist today will either remain to be discovered or will be dealt with as appropriate. Future problems, although they may be difficult to detect, will arise out of new and different arrangements of products and human exposure to them. Because of this, it is necessary to know what the changes in economic activity are likely to occur.

Data Base

A major source of information regarding future growth of products is in the historical growth data. However, historical growth is included as a separate parameter and therefore an alternative source was sought for

TABLE 5. TOP 25 PRODUCTS BY HISTORICAL GROWTH RATE

Product Code	Product Name	Growth Rate, percent
28219 13	Polyethylene Monofilaments	86.89
28199 98	All Other Inorganic Chemicals, N.E.C.	36.85
28199 91	Radioactive Isotopes shipped from non-AEC plants producing isotopes	35.49
28514 21	Semigloss Water Emulsion Paints and Tinting Bases	33.55
28215 11	Epoxy (synthetic resin adhesives)	30.74
28794 71	Rodenticides - Fumigants other than soil fumigants, including space	30.29
28241 33	Staple, Tow, and Salable Waste	30.19
28992 99	Fatty Acids, n.s.k.	30.19
28311 11	Blood and Blood Derivatives	27.95
28341 43	Antineoplastic Agents: Radioactive Isotopes for internal use Specific Antineoplastic Agents	26.89
28213 51	Polypropylene Resins	25.01
28315 23	Vaccines and Viruses	24.25
28914 99	Synthetic Resins and Rubber Adhesives, n.s.k.	24.18
28511 33	Automotive and Machinery Refinish Paints and Enamels, except lacquers	24.13
28211 15	Cellulosic Unsupported Film, Sheets, and Sheeting, less than 3.0 mils	23.09
28792 85	Other Weed Killers (hydrocarbon, etc.) including Defoliants (except sodium chlorate preparations), Desiccants (including arsenic acid), Algaecides, Carbamates (including CIPC, EPTC, CDAA, etc.)	23.06
28518 53	Putty and Glazing Compounds	22.01
28315 98	Other Biologics including antitoxins, toxoids, and diagnostics	21.96
28345 73	Other Diuretics	21.55
28162 99	Other White Opaque Pigments, n.s.k.	21.49

TABLE 5. (Continued)

Product Code	Product Name	Growth Rate, percent
28342 95	Other Eye and Ear Preparations, including contact lens solutions	21.05
28345 25	Fecal Softeners	20.92
28932 31	News Inks, Publication Inks	20.50
28214 98	Other Thermosetting Resins and Plastics Materials, including alkyd (not for protective coatings)	20.47
28349 45	Parasiticides, External	20.38

Source: Battelle program output.

future growth rather than extrapolations (or other more sophisticated relative shares analysis or time series analysis) of historical growth to arrive at figures for future growth. Another alternative that was considered as a source is Predicasts data on product growth.(37) However, these data were not available in a consistent pattern over all the sectors of the economy and associated products of concern. Selected literature on various products and industries is available that indicates potential for future growth and expansion, but these sources, as others, are not comprehensive and do not cover all the products that are being screened.

The comprehensiveness was obtained by using a national input-output table that has been developed at Battelle. This table is prepared by consulting with experts in the industries represented by the various sectors of the economy. These experts provide estimates of the requirements by a subject industry (as inputs) from all other industries. The table is constructed for 1970 and 1985 based on expert opinion. It is used to show the growth of economic activity by sector over that time period.

The advantage of using these data is that it represents information regarding the direction that industries are moving, over time, in changing their products and their input requirements. Although the long time period suggests that the data must be subject to significant uncertainty, in fact, the judgments that are made for future activity for an industry are based on technology and requirements that are already on the drawing boards for the subject industries. The capital budgets of the industries must be formulated far enough in advance to permit planning, design, and construction of the required facilities. For major technological changes this may be as much as 10 or 15 years while for less dramatic changes in operating procedures, the time period would be less.

Output vectors for years 1970 and 1985 were calculated, partly conditioned by potential technological change, with the results being expressed as a percentage annual growth by sector. The rate of growth by sector was then applied to all of the products that are produced for the given sector.

Table 6 shows the projected annual growth rates for industries in Allied and Chemical Products for the time period 1970 to 1985. These are the data used in the ranking program. Appendix C contains a complete listing of future growth rates for all sectors of the economy.

Dispersion

In determining the extent to which a product embodies a future pollution problem, human exposure to the product is an important factor. We are exposed to products in several ways. Exposure may occur in the work place where many various substances may be combined to produce a product and where the individual may be exposed to more dangerous forms of input materials. Products are used both as input to other production processes and in final consumption. Thus, the individual may also be exposed to the product in the home or other area where it is consumed. The more widely dispersed a product is, throughout the economy, the more likely an individual is to be exposed to it. The "dispersion index" was developed to capture this exposure.

Data Base

The index was designed to capture both the extent to which products are transferred to other sectors of the economy and the volume of the transfers. In the input-output framework, the "inverse" matrix was chosen as indicative of the total transactions that take place in the economy. Cells in the row of an inverse indicate the extent to which products are delivered to all other sectors from the sector represented by the subject. This includes both the direct requirements from other industries and the indirect requirements by other sectors to produce products for input into the subject sector. Thus, these coefficients represent the dispersion of a given sector of the economy. An index that would permit a comparison of dispersion among sectors was developed.

TABLE 6. FUTURE GROWTH OF CHEMICALS AND ALLIED PRODUCTS

Sector Number	SIC Number	Sector Name	Annual Rates of Change 1970-1985
5.03	2812	Alkalies and Chlorine	3.00
5.03	2813	Industrial Gases	3.83
5.03	2815	Cyclic Intermediates and Crudes	4.69
5.03	2816	Inorganic Pigments	3.49
5.03	2818	Industrial Organic Chemicals	3.67
5.03	2819	Industrial Inorganic Chemicals	3.33
5.04	2871	Fertilizers	4.08
5.04	28722	Fertilizers, Mixing Only	3.90
5.05	28790	Agricultural Chemicals, except Fertilizers	3.99
5.06	2861	Gum and Wood Chemicals	3.81
5.06	2891	Adhesives and Gelatin	4.20
5.06	28921	Explosives, except Government-owned	3.23
5.06	28930	Printing Ink	3.96
5.06	28950	Carbon Black	4.30
5.06	2899	Chemical Preparations, N.E.C.	4.34
5.07	2821	Plastics Materials and Resins	4.59
5.07	28220	Synthetic Rubber	3.87
5.08	2823	Cellulosic Man-made Fibers	3.12
5.08	2824	Organic Fibers, Noncellulosic	5.50
5.09	2831	Biological Products	5.08
5.09	2833	Medicinals and Botanicals	3.44
5.09	2834	Pharmaceutical Preparations	2.88
5.10	2841	Soap and Other Detergents	2.92
5.10	2842	Polishes and Sanitation Goods	3.91
5.10	28430	Surface Active and Finishing Agents	3.92
5.11	2844	Toilet Preparations	3.23
5.12	2851	Paints and Allied Products	3.27

Source: PREVIEWS 85 program output.

Dispersion Index

Assuming that maximum dispersion would be represented by a row with all equal entries, an index based on the entropy concept used in information theory (originating in thermodynamics) was developed. In this technique, relative shares are weighted by their respective logarithms and summed to produce an index of the degree of dispersion.

For example, a distribution with equal relative shares should show more dispersion than a distribution in which one of the shares is very large and the rest small.

The strength of this approach rests on the mathematical relationship between fractions and their logarithms. In moving from 1 to 0 the corresponding logarithms increase in absolute terms at a rate faster than the decrease in the fraction. Above 0.10 the logarithm, when multiplied by the corresponding fraction, results in proportionally increased reductions in the value of the fraction the closer to 1 that number is. For one, the product, of course, is zero. Below 0.10 the weighting scheme increases the value assigned to each element. Using this approach, distributions that are widely dispersed will produce a higher index number or entropy value than distributions in which one or two of the values are very large and the rest are relatively small.

Formally this is given by:

$$H(p_1, p_2, \ldots p_n) = - \sum_{k=1}^{n} p_k \log p_k$$

where the entropy $[H(p_k)]$ of the distribution $p_1, \ldots, p_n$ is calculated by summing the product of each value p_k by its respective logarithm ($\log p_k$).

Assuming that interindustry output dispersion is the major focus, the entropy value of each sector row (output distribution) for the inverse (matrix of direct and indirect requirements) is given by:

$$E^i = \sum_{j=1}^{n} \left[\frac{x_{ij}}{\sum\limits_j x_{ij}} \log \left(\frac{x_{ij}}{\sum\limits_j x_{ij}} \right) \right]$$

where E^i is the entropy value for the output of each industry and x_{ij} is the coefficient value for the i^{th} row, j^{th} column of the inverse.

The input-output framework is used in conjunction with entropy measurement to establish dispersion indices for comparing various sectors of the economy.

The coefficient that was used in the calculations for the overall index to rank products, based on the "entropy" concept, was calculated for the 1967 national input-output table. The results of this calculation for all sectors are presented in Table 7. An alternative approach to calculating the dispersion index is presented in Appendix D for the interested reader. The alternative has a great deal of intuitive appeal but there was insufficient time and resources to develop it sufficiently to use results from it.

Dispersion to Final Demand

In the calculation of the dispersion coefficient, the extent to which products are actually consumed by final users is an important factor. The input-output approach does not address directly the extent to which the user is exposed. However, if we assume that the user is exposed in proportion to the dollar value of the goods that he consumes, final demand by sector can be used as a proxy variable for exposure directly to the consumer. The alternative approach to calculating exposure embodies this factor in one element of the index; however, the development of an index of exposure of consumers to products deserves greater emphasis than was possible in this methodology development study.

There are a variety of ways in which the individual might be exposed to potential pollutants. In addition, there are a variety of ways in which products or their constituents might eventually result in exposure of humans. For example, burning of wastes might result in undue general exposure. Hazards may result from use of products in combination with other

TABLE 7. INDEX OF OUTPUT DISPERSION BY SECTOR

Industry Number[1]	Related SIC Codes[2]	Industry Title	Output Dispersion
1	0132-0193	Livestock and Livestock Products	1.90
2	0112-0192	Other Agricultural Products	2.83
3	074-091	Forestry and Fishery Products	0.49
4	071-098	Agricultural, Forestry, Fishery Services	0.33
5	1011-106	Iron and Ferroalloy Ores Mining	0.48
6	102-109	Nonferrous Metal Ores Mining	0.73
7	11,12	Coal Mining	1.13
8	1311,1321	Crude Petroleum and Natural Gas	0.81
9	141-149	Stone and Clay Mining and Quarrying	1.02
10	147	Chemical and Fertilizer Mineral Mining	0.58
11	Part 15-17, 6561	New Construction	0.60
12	Part 138-17	Maintenance and Repair Construction	4.21
13	1925-1929	Ordnance and Accessories	0.78
14	20	Food and Kindred Products	2.31
15	21	Tobacco Manufactures	0.44
16	2211-2283	Broad and Narrow Fabrics, Yarn and Thread Mills	2.48
17	2291-2299	Miscellaneous Textile Goods and Floor Coverings	1.01
18	2251-238	Apparel	1.22
19	2391-2399	Miscellaneous Fabricated Textile Products	0.90
20	2411-2499	Lumber and Wood Products, except Containers	3.06
21	244	Wooden Containers	0.43
22	251	Household Furniture	0.82
23	2521-2599	Other Furniture and Fixtures	0.40
24	264	Paper and Allied Products, except Containers	3.38
25	265	Paperboard Containers and Boxes	3.11

TABLE 7. (Continued)

Industry Number(1)	Related SIC Codes(2)	Industry Title	Output Dispersion
26	27	Printing and Publishing	2.18
27	281-289	Chemicals and Selected Chemical Products	5.72
28	2821-2824	Plastics and Synthetic Materials	2.69
29	283-2844	Drugs, Cleaning, and Toilet Preparations	1.38
30	2851	Paints and Allied Products	1.58
31	29	Petroleum Refining and Related Industries	3.86
32	30	Rubber and Miscellaneous Plastics Products	5.44
33	3111-3121	Leather Tanning and Industrial Leather Products	0.78
34	3131-3199	Footwear and Other Leather Products	0.41
35	3211-3221	Glass and Glass Products	1.52
36	3241-3299	Stone and Clay Products	2.90
37	331-3399	Primary Iron and Steel Manufacturing	8.59
38	3331-3392	Primary Nonferrous Metal Manufacturing	6.20
39	3411-3491	Metal Containers	0.92
40	3431-3449	Heating, Plumbing, and Structural Metal Products	1.92
41	345-3461	Stampings, Screw Machine Products and Bolts	3.90
42	3421-3499	Other Fabricated Metal Products	5.12
43	3511-3519	Engines and Turbines	1.59
44	3522	Farm Machinery and Equipment	0.71
45	3531-3533	Construction, Mining, and Oil Field Machinery	1.70
46	3534-3537	Materials Handling Machinery and Equipment	0.77
47	3541-3548	Metalworking Machinery and Equipment	2.90
48	3551-3559	Special Industry Machinery and Equipment	0.94
49	3561-3569	General Industrial Machinery and Equipment	2.99

TABLE 7. (Continued)

Industry Number(1)	Related SIC Codes(2)	Industry Title	Output Dispersion
50	359	Machine Shop Products	2.32
51	3573-3579	Office, Computing, and Accounting Machines	0.67
52	3581-3589	Service Industry Machines	1.07
53	3611-3629	Electric Industrial Equipment and Apparatus	3.29
54	3631-3639	Household Appliances	0.84
55	3641-3644	Electric Lighting and Wiring Equipment	1.50
56	3651-3662	Radio, Television, and Communication Equipment	1.73
57	3671-3679	Electronic Components and Accessories	2.14
58	3691-3699	Miscellaneous Electrical Machinery, Equipment, and Supplies	1.22
59	3713-3715	Motor Vehicles and Equipment	2.34
60	3721-3729	Aircraft and Parts	1.59
61	3731-3799	Other Transportation Equipment	0.80
62	3811-387	Scientific and Controlling Instruments	1.69
63	3831-3861	Optical, Opthalmic, and Photographic Equipment	1.18
64	391-3999	Miscellaneous Manufacturing	1.85
65	40-47	Transportation and Warehousing	8.32
66	48	Communications, except Radio and TV Broadcasting	3.48
67	483	Radio and TV Broadcasting	0.42
68	491-497	Electric, Gas, Water, and Sanitary Services	6.20
69	50-59, 7396	Wholesale and Retail Trade	12.08
70	60-64	Finance and Insurance	4.62
71	65-66	Real Estate and Rental	9.92
72	70-724	Hotels, Personal and Repair Services except Auto	1.52
73	73-89	Business Services	11.34

TABLE 7. (Continued)

Industry Number(1)	Related SIC Codes(2)	Industry Title	Output Dispersion
75	75	Automobile Repair and Services	1.88
76	78,79	Amusements	0.90
77	801-8921	Medical, Educational Services, and Nonprofit Organizations	1.07
78	(3)	Federal Government Enterprises	1.56
79	(3)	State and Local Government Enterprises	0.95
80A	(3)	Directly Allocated Imports	1.42
80B	(3)	Transferred Imports	7.98
81	(3)	Business Travel, Entertainment, and Gifts	4.87
82	(3)	Office Supplies	0.96

(1) The following industry numbers were assigned to sectors in the 1967 Input-Output tables of the Survey of Current Business, 54 (2), (February, 1974).

(2) Survey of Current Business provides bridge table converting Input-Output sector numbers to SIC codes. The SIC codes employed in this table are from the 1967 edition of the codification manual.

(3) SIC codes for these sectors were not available.

products, or the individual might be systematically exposed to hazardous materials in other routine activities (such as the use of deodorants or in use of the automobile).

The dispersion coefficient is only a very simplified approach to summarizing the possible exposure that might result in the use of goods and services. A more detailed index that incorporates information on exposure in use of a product, exposure in consumption, and exposure in disposal of residues could be developed but is beyond the scope of this methodology development.

Technical Change

Sectors of the economy that have undergone rapid and extensive technological change in the past are the sectors that have caused or resulted in a large number of the pollutants that we are having to cope with now. The recent emphasis on the technique of technology assessment is an indicator of the potential for unwanted or unexpected results that can occur if all the ramifications of new technology are not explored. Because technology appears as a possible indicator of future problems, a factor that indicates the rate of technological change for a sector of the economy was developed.

Technical change is likely to cause unanticipated repercussions because a new technology requires a new and different mix of input products to produce a unit of output for a given sector. Therefore, identification of the sectors of the economy that are likely to experience rapid technological change would be one way to identify industries that should be examined for possible future pollution problems.

Data Base

To measure technological change requires that one identify sectors in which new technologies will be applied in producing the output of the sector. The impetus for such change stems from several factors, including the necessity for new technology because of resource depletion.

In addition, the process for producing resources might become more costly, increasing the cost of the resource. If that were the case, alternative technologies for production would be warranted if the result were production at a per unit cost, that is, low enough to justify the capital cost of the technology. Chief among the inputs that were becoming more expensive in the past was manpower. The trend in technological change was away from labor powered or operated technologies toward more capital intensive, automatic equipment type technologies. With the new emerging shortages of raw material inputs and energy constraints to production, the shift will be towards technologies that economize on these inputs. As that occurs, new and different pollution problems are likely to emerge.

Another factor that complicates the analysis of technological change is the necessity for knowing when a new technology is actually in place. Is it in place when the first plant uses it? Is it in place when 50 percent of all production for a given industry is produced by it? Or is it in place only when 95 percent of all production of a given sector is using the new technology? Developing a uniform method of measuring technical change for comparing it with other sectors of the economy is very difficult.

Because of the difficulties in measuring and comparing technological change amont sectors, a proxy variable was used that is based on changes in the input requirements for an industry. Using this variable, it was possible to compare the structure of a given sector of the economy with the structure of the same sector at a different time period. Industries with high rates of change among input requirements were ranked high and sectors with little change in the input requirements were ranked low in terms of structural change.

An industry may have significant technological change but show little or no change in the input requirements. This possibility does not weaken this analysis because we are looking for industries that might be using more or different types of inputs from the mix that they had been using. The important question is whether or not the input mix has changed, not so much whether technological change has taken place or not.

The concept of structural change is not a new one although the measurement of the change has traditionally been done using a different approach from that applied here.(6) In this analysis the two input-output tables for the years 1970 and 1985 are compared. Each sector is analyzed to determine an index of the change in the coefficients expected over that time period. Industries that are expected to have a high rate of technological (structural) change over that time period are presented in Table 8. The higher the index, the greater the expected structural change. The complete listing of sectors and their indices is presented in Appendix E.

Technical Change Index

The indices that were developed to indicate technological change use the coefficients for a column, representing a given sector, and compare them for the years 1970 and 1985. The direct technical coefficients are compared. They represent the percentage a given input is of the total inputs required to produce a unit of output for the subject sector. If, for example, the input requirements of petroleum products in the production of steel were to change from a large to a small percentage, one would infer a structural change for that industry. Those sectors that have many such changes would have more of a structural change than those industries that had few input requirement changes.*

Included in the input vector is a value added component. This provides a measure of the requirements for labor inputs to production.** Thus, industries with a high value added generally will have a high labor input requirement. In addition, capital cost components are included in this figure and thus, high value added might also imply changes in the capital requirements of an industry. In either case, stable value added would generally imply less technical change than rapidly changing value added.

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* The vector of inputs is a vector of the value of inputs. Therefore, pace changes over the subject period may influence the change in the entries in the vector. However, for this analysis it was not possible to make price adjustments, introducing some inaccuracy in the ranking according to this index.

**Value added includes wages, profits, and taxes, most of which is payment to labor, although this will vary from sector to sector.

TABLE 8. TOP 25 SECTORS BY STRUCTURAL CHANGE OF PRODUCT

Rank	Sector Number	Sector Name	Index
1	21.03	Hotels and Lodging Places	.013158
2	1.03	Forestry and Fishery Products	.012560
3	14.01	Scientific Instruments, etc.	.012093
4	5.02	Paving Mix and Asphalt Products	.011441
5	6.04	Other Nonmetal Mineral Products	.010575
6	1.04	Agriculture, Forestry, and Fishery Services	.010354
7	4.01	Sawmills and Planing Mills	.010340
8	14.03	Watches, Clocks, and Parts	.010322
9	2.05	Crude Petroleum and Natural Gas	.010227
10	5.08	Organic Man-made Fibers	.010021
11	10.01	Farm Machinery	.009752
12	19.02	New Construction, Nonresidential Buildings	.009741
13	10.04	Oil Field Machinery	.008979
14	4.02	Veneer and Plywood	.008928
15	11.05	Cycles, Trailers, etc.	.008605
16	3.07	Tire Cord and Miscellaneous Textile Goods	.007989
17	4.03	Lumber and Wood Products except Containers	.007825
18	11.02	Aircraft and Parts	.007528
19	3.05	Fabrics, Yarns, and Threads	.007304
20	17.02	Local and Highway Passenger Transport	.007280
21	8.04	Nonelectric Heating Equipment	.007272
22	2.01	Iron and Ferroalloys Ores	.006959
23	3.06	Soft Floor Coverings	.006704
24	17.03	Motor Freight and Warehouse	.006702
25	12.05	Light Fixtures and Wiring Devices	.006356

Source: Battelle estimates.

The approach that was used in the development of the index for the calculation of the rank of products was to estimate the difference between the percentage that each input constitutes for the subject years, square, sum, and divide by the number of observations (128) and take the square root. The formula is as follows:

$$I_j = \sqrt{\frac{\sum_i (t_{ij} - t'_{ij})^2}{n}} \text{ , where } n = 128,\ i = 1,2,3,\ \ldots\ 127 \text{ sectors.}$$

I_j = structural change index for the j^{th} sector.

t_{ij} = technical coefficient for the i^{th} input sector (1970)

t'_{ij} = technical coefficient for the i^{th} input sector (1985)

An Alternative Index

Although the approach to calculate I_j has a great deal of intuitive appeal, it was felt that an alternative approach would provide a check or test of the validity of I_j. Unfortunately, the results do not strongly support the selected index, suggesting that more resources should be devoted to improving this index.

In this approach, a column of percentages of inputs required for a sector for a given time period is compared directly with a similar column for a subsequent time period by calculating a correlation coefficient between the two columns. The Kendall Rank-Order Correlation Coefficient was used to compare input vectors for each sector for the years 1970 and 1985. The Kendall coefficient produces "standardized coefficients based on the amount of agreement between two sets of ordinal rankings".(33) In this respect it may represent a method superior to I_j for comparing the columns because no correction is made for growth in input requirements necessary to produce additional output. The results of the calculation of the Kendall coefficient are presented in Appendix E and the top 25 sectors experiencing structural change over the time period are listed in Table 9. The higher the correlation coefficient between the two vectors, the less structural change is assumed to be taking place.

TABLE 9. TOP 25 SECTORS CALCULATED USING THE KENDALL COEFFICIENT

Rank	Sector Number	Sector Name	Kendall Coefficient
1	14.02	Medical, Surgical, and Dental Instruments	.8912
2	21.04	Personal and Repair Services except Cars	.9223
3	2.01	Iron and Ferroalloys Ores	.9262
4	11.05	Cycles, Trailers, etc.	.9267
5	4.01	Sawmills and Planing Mills	.9277
6	4.03	Lumber and Wood Products except Containers	.9285
7	19.01	New Construction, Nonfarm Residential	.9286
8	12.06	Electronic Components and Accessories	.9320
9	5.02	Paving Mix and Asphalt Products	.9344
10	17.01	Railroads and Related Services	.9354
11	18.03	Gas	.9354
12	11.02	Aircraft and Parts	.9403
13	8.04	Nonelectric Heating Equipment	.9405
14	11.03	Ship and Boat Building and Repairs	.9409
15	17.04	Water Transportation	.9425
16	14.03	Watches, Clocks, and Parts	.9442
17	11.04	Locomotives and Rail and Streetcars	.9443
18	3.07	Tire Cord and Miscellaneous Textile Goods	.9448
19	10.04	Oil Field Machinery	.9453
20	6.04	Other Nonmetal Mineral Products	.9461
21	12.01	Electrical Measuring Instruments	.9466
22	17.03	Motor Freight and Warehouse	.9474
23	12.03	Industrial Controls, etc.	.9510
24	4.06	Other Furniture and Fixtures	.9514
25	6.02	Cement and Lime and Gypsum Products	.9541

Source: Battelle calculations.

Comparing this list of the top 25 with the list generated for I_j indicates that there is not complete agreement between the two approaches regarding the sectors with the highest rates of structural change. This difference is explained, in part, by the differences in the method of calculation as explained. Nevertheless, almost half of the sectors are repeated under both approaches.

Value of Shipments of Products

The product that is distributed in larger quantities, especially if it is toxic to any degree, is more likely to be of concern than a product that is distributed in smaller quantities. Products shipped in small quantities may contain highly toxic substances, but they are less threatening than products that are also highly toxic but are shipped in large quantities. Quantity data are difficult to obtain uniformly over all products; therefore, value of shipments data were used as a substitute.* Value of shipments data are used to rank products according to their importance.

Data for value of shipments were derived from the Census of Manufactures, Table 3 in the 1972 Preliminary Report, and Table 6A in the 1963 and 1967 Final Reports. The Census collected information on both quantity and value of shipments of products; however, if there were no meaningful physical quantity measures reported, only value of shipments was collected.

As a result, some industries in Major Group 28 reported no measures of quantity at all, while some industries reported quantity for some products and not for others. Measures of quantity were not reported either because (1) figures were not applicable, (2) figures were not available or (3) figures were withheld "because the estimate did not meet publication standards, either on the basis of the associated standard error of the estimate or on the basis of a consistency review". For this reason, value of shipments was used to indicate the volume of a product. The weakness of this approach, that value may be uncorrelated with volume, is recognized and is reflected in the lower weight attached to the value variable.

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* Price adjustments have not been made in the value of shipments data.

Other Parameters Considered

In the initial stages of the development of the ranking procedure, and as indicated in the second methodology (see Figure 4), the toxicological potential for various products was judged to be an important variable that would help establish the potential for future pollution problems. The results of the efforts to rank SIC's according to their potential toxicity are summarized in Table 2 and provide the basis for the selection of the group of SIC's, the 2800's, for more detailed consideration. However, the general conclusion was that it is very difficult to rank products according to their potential toxicity before they have been tested because the product is usually composed of a large number of individual chemicals in varying amounts, each of which has a differing toxicity rating.

Identification of the chemical make-up is not an impossible task but is is a task that would require a great deal of effort. Because this task would require a large amount of resources to complete for all products, it is suggested that this be begun only after a higher priority listing of chemicals based on other criteria be developed.

A consequence of this finding is that it would be very costly to attempt to begin the screening of products with a preliminary screening based on toxicity. Because of this, it is suggested that the preliminary screening of products be done on the basis of a refined economic model and that subsequent, more detailed investigation include the toxicity screening.

SECTION VI

PRODUCT RANKING

Product Ranking Results

In the initial phases of this study, the alternative approaches that have been taken by agencies and institutions in the development of methodologies were reviewed. The economic-based approach was adopted because it provided the opportunity for futuristic, comprehensive, and systematic approaches that appeared lacking in the other approaches that were reviewed. However, it was found infeasible to perform detailed toxicological screening on a variety of products at an early stage of the screening process because the variety of chemicals in a given product were found to be very high. The initial, detailed screening was performed on the basis of economic criteria including

- Growth
- Technical change
- Dispersion
- Value of product.

This approach involved using data that relate to products produced and exchanged to identify those products that are potential candidates for being associated with future toxic substance pollution problems.

Program Output

The main effort in this study was in the development of the economic screening portion of the methodology. The results of the application of the methodology to the products in Chemicals and Allied Products (SIC 28) are presented in Appendix F. The products are ranked according to their composite score composed of the selective parameters. Table 10 presents the top 50 products from the ranking.

Examining the details of the ranking from Appendix F, it is possible possible to identify what factors lead to the high ranking of various products.* In Appendix F - The Composite Product Ranking is presented. Both the weighted and unweighted indices for historical growth, future growth, dispersion, technical change and value of shipments are presented in the listing. Next, examples of items from Table 10 are discussed, including the rationale for their relative ranking.

(1) Staple, Tow, and Salable Waste (Organic Fibers, Noncellulosic) 28241 33

This product category scored very high in both future growth and in technical change parameters. It was fairly high in historical growth also. Compared to other products in this composite ranking, dispersion is not very high and the value of product is relatively low.

(2) Miscellaneous Acyclic Chemicals and Chemical Products (excluding Urea) (Industrial Inorganic Chemicals) 28692 13

This product category scored very high because both dispersion and value parameters were ranked high. In addition, the historical growth parameter was relatively high. The very high value of this product category and the large number of potential products in such a general category suggest that this category warrants additional attention.

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* Appendix F does not include product names but Appendix G contains a complete cross reference between product code and product name.

TABLE 10. TOP 50 PRODUCTS RANKED ACCORDING TO POTENTIAL FOR FUTURE TOXIC SUBSTANCE POLLUTION PROBLEMS, USING CRITERIA DEVELOPED IN THIS STUDY

Rank	Product Code	Product Name
(1)	28241 33	Staple, Tow, and Salable Wastes (Organic Fibers, Noncellulosic)
(2)	28692 13	Miscellaneous Acyclic Chemicals and Chemical Products (excluding urea) (Industrial Inorganic Chemicals)
(3)	28992 99	Fatty Acids, n.s.k. (Chemical Preparations, N.E.C.)
(4)	28219 13	Polyethylene Monofilaments (Plastics Materials and Resins)
(5)	28242 51	Polyester Filament Yarn and Textile Monofilaments, Staple, and Tow (Organic Fibers, Noncellulosic)
(6)	28241 15	Filament Yarn and Textile Monofilaments (Organic Fibers, Noncellulosic)
(7)	28794 71	Rodenticides - Fumigants other than Soil Fumigants, including space (Agricultural Chemicals, N.E.C.)
(8)	28792 35	Other Weed Killers (hydrocarbon, etc.) including Defoliants (except sodium chloride preparations), Desiccants (including arsenic acid), Algaecides, Carbamates (including CIPC, EPTC, CDAA, etc.) (Agricultural Chemicals, N.E.C.)
(9)	28242 31	Acrylic and Modacrylic Filament Yarn and Textile Monofilaments, Staple, and Tow (Organic Fibers, Noncellulosic)
(10)	28914 99	Synthetic Resins and Rubber Adhesives, n.s.k. (Adhesives and Sealants)
(11)	28995 13	Other Essential Oils, Unblended (natural) (Chemical Preparations, N.E.C.)
(12)	28914 11	Epoxy Adhesives, Phenolics, and Derivatives Adhesives (Adhesives and Sealants)
(13)	28995 39	Concrete Curing and Floor Hardening Materials (Chemical Preparations, N.E.C.)
(14)	28995 91	Plating Compounds (Chemical Preparations, N.E.C.)
(15)	28242 71	Filament Yarn and Textile Monofilaments of other Man-made Fibers (except glass) including Saran, Spandex, Anidex (extruded and split), Vinyon, Fluorocarbon, etc. (Organic Fibers, Noncellulosic)
(16)	28995 12	Essential Oils, Unblended (natural) (lemon) (Chemical Preparations, N.E.C.)
(17)	28995 41	Drilling Mud Materials, Mud Thinners, Thickeners, and Purifiers (Chemical Preparations, N.E.C.)

TABLE 10. (Continued)

Rank	Product Code	Product Name
(18)	28791 49	Other Agricultural Insecticidal Preparations and/or Concentrates including Petroleum Oil Sprays and Emulsions without other Toxicants, excluding Botanicals (Agricultural Chemicals, N.E.C.)
(19)	28995 77	Water-treating Compounds: Boiler Compounds, Other Water Softening Compounds (Chemical Preparations, N.E.C.)
(20)	28995 93	Lighter Fluids (cigarettes, charcoal, etc.) (Chemical Preparations, N.E.C.)
(21)	28995 81	Waterproofing Compounds (electrical, leather, masonry, textile, etc.) (Chemical Preparations, N.E.C.)
(22)	28995 95	Waxes (animal, vegetable, mineral, including blends) excluding pure petroleum waxes. Other Industrial Chemical Specialties, including fluxes and plastic wood preparations (Chemical Preparations, N.E.C.)
(23)	28995 63	Sizes: Rosin Sizes, Other including dextrin sizes (Chemical Preparations, N.E.C.)
(24)	28992 92	Tall Oil Fatty Acids: Tall Oil Fatty Acids containing less than 2% rosin acids and more than 95% fatty acids. Tall Oil Fatty Acids containing 2% rosin acids or more (Chemical Preparations, N.E.C.)
(25)	28995 35	Automotive Chemicals: Antifreeze Preparations, Other Automotive Chemicals (including battery acid, deicing fluid, carbon-removing solvents, etc.) (Chemical Preparations, N.E.C.)
(26)	28791 43	Organic Phosphate-containing Preparations - Preparations containing parathion as the active ingredient, or methyl parathion as the active ingredient, or other organic phosphates as the active ingredient (Agricultural Chemicals, N.E.C.)
(27)	28914 83	Rubber Cement for sale as such (solvent type) (Adhesives and Sealants)
(28)	28995 11	Essential Oils, Unblended (natural) (orange) (Chemical Preparations, N.E.C.)
(29)	28995 29	Fireworks and Pyrotechnics (including flares, jet fuel igniters, railroad torpedoes, toy pistol caps, etc.) (Chemical Preparations, N.E.C.)
(30)	28793 71	Soil Fumigants (Agricultural Chemicals, N.E.C.)
(31)	28995 19	Other Natural Essential Oils (Chemical Preparations, N.E.C.)
(32)	28995 15	Peppermint Oils (Chemical Preparations, N.E.C.)

TABLE 10. (Continued)

Rank	Product Code	Product Name
(33)	28995 49	Foundry Supplies, Chemical (including binders, core oils, core wash, etc.) (Chemical Preparations, N.E.C.)
(34)	28932 31	News Inks, Publication Inks (Printing Ink)
(35)	28992 11	Saturated Acids: Stearic Acid (40-50% stearic content) (Chemical Preparations, N.E.C.)
(36)	28992 23	Hydrogenated Animal and Vegetable Acids: Hydrogenated Fatty Acids having a maximum titer of 60° and minimum I.V. of 5. Hydrogenated Fatty Acids having minimum titer of 57°C and maximum I.V. under 5. High Palmitic (over 60° palmitic, I.V. maximum of 12). Hydrogenated Fish and Marine Mammal Fatty Acids (Chemical Preparations, N.E.C.)
(37)	28995 61	Oil-treating Compounds (non-oil base) (Chemical Preparations, N.E.C.)
(38)	28995 72	Inks (writing and stamp pad inks, including indelible ink and marking fluid, but excluding drawing inks) (Chemical Preparations, N.E.C.)
(39)	28995 99	Essential Oils, Fireworks and Pyrotechnics, Sizes, and Chemical Preparations, N.E.C., n.s.k. (Chemical Preparations, N.E.C.)
(40)	28991 11	Evaporated Salt (bulk, pressed blocks, and packaged) (Chemical Preparations, N.E.C.)
(41)	28995 87	Vitreous Enamel (frit) (Chemical Preparations, N.E.C.)
(42)	28995 59	Metal-treating Compounds (non-oil base) for nitriding, pickling, drawing, and cutting) (Chemical Preparations, N.E.C.)
(43)	28992 61	Unsaturated Acids: Oleic Acid, including white oleic and red oil (Chemical Preparations, N.E.C.)
(44)	28913 78	Bituminous Adhesives, Asphaltic and Coal Tar, other natural base glue and adhesives made from natural gums, shellac, silicates, lacquers, oleoresinous varnishes, etc., except rubber (Adhesives and Sealants)
(45)	28794 15	Nonaerosol Insecticides for flying insects, excluding fumigants (Agricultural Chemicals, N.E.C.)
(46)	28913 55	Vegetable Adhesive Starches (Adhesives and Sealants)
(47)	28992 83	Other Unsaturated Fatty Acids, including animal fatty acids other than oleic (I.V. 36 to 80), vegetable or marine (I.V. maximum 115), and other unsaturated fatty acids (I.V. 116 and over) (Chemical Preparations, N.E.C.)

TABLE 10. (Continued)

Rank	Product Code	Product Name
(48)	28994 31	Pharmaceutical Grade (except unfilled capsules) (Chemical Preparations, N.E.C.)
(49)	28793 98	Other Agricultural Chemicals, N.E.C. such as disinfectants, animal dips, and soil conditioners (Agricultural Chemicals, N.E.C.)
(50)	28793 67	Copper-containing Dry Preparations, including dry Bordeaux mixtures but excluding Paris Green and copper sulfate (Agricultural Chemicals, N.E.C.)

Source: Battelle ranking program.

(3) Fatty Acids, n.s.k. (Chemical Preparations, N.E.C.) 28992 99

This product category scored very high in dispersion. The dispersion score and moderate scores in historical and future growth and in technical change placed this item high on the list.

(4) Polyethylene Monofilaments (Plastics Materials and Resins) 28219 13

This product scored very high in historical growth. Combined with moderately high scores in all other parameters except value, the overall ranking is high.

(5) Polyester Filament Yarn and Textile Monofilaments, Staple, and Tow (Organic Fibers, Noncellulosic) 28242 51

High ranking in future growth and in technical change combined to rank this product and Filament Yarn and Textile Monofilaments (Organic Fibers, Noncellulosic) high.

(6) Filament Yarn and Textile Monofilaments, (Organic Fibers, Noncellulosic)

Very high ranking in historical growth.

(7) Rodenticides - Fumigants other than Soil Fumigants, including Space (Agricultural Chemicals, N.E.C.) 28794 71

Very high dispersion combined with moderately high scores in other categories services to place Rodenticides high on the list.

Distribution of Products by 4-Digit SIC

Fourteen 4-digit SIC's are represented in the top 100 products ranked by the composite index. Table 11 shows the distribution of the 100 products over the subject 4-digit SIC's or industries. The interesting factor is that 81 of the 100 products are collected in 5 SIC's. Industrial Organic Chemicals, N.E.C. (SIC 2869) contains 7 of the top 100 products, Agricultural Chemicals, N.E.C. (SIC 2879) contains 22, Adhesives and Sealants (SIC 2891) contains 12, Printing Ink (SIC 2893) contains 8, and Chemical Preparations, N.E.C. (SIC 2899) contains 32 of the top 100 products. This distribution suggests that within Chemicals and Allied Products (2800's), these industries represent those with the greatest potential for future toxic substance pollution problems based on the parameters that were used to prepare the composite ranking. It should be recognized, however, that these results are presented primarily as examples of the way the procedure would operate. Confidence in the results would be improved through further work on parameters and better data.

The full application of the methodology to all products would indicate what industries are likely to require more attention as possible sources of future pollution problems. Three of the categories, Industrial Organic Chemicals, Agricultural Chemicals, and Chemical Preparations are "residual" categories in the Census of Manufactures. An examination of products in these categories shows a wide variety of products that do not fit in other areas. It is, however, in these categories, that many pollution problems have arisen in the past and are likely to do so in the future.

TABLE 11. DISTRIBUTION OF PRODUCTS BY 4-DIGIT SIC

4-Digit SIC	Name	Number of Products
2813	Industrial Gases	4
2816	Inorganic Pigments	1
2819	Industrial Inorganic Chemicals, N.E.C.	2
2821	Plastics Materials and Resins	1
2824	Organic Fibers, Noncellulosic	5
2861	Gum and Wood Chemicals	1
2865	Cyclic Crudes and Intermediates	3
2869	Industrial Organic Chemicals, N.E.C.	7
2874	Phosphatic Fertilizers	1
2879	Agricultural Chemicals, N.E.C.	22
2891	Adhesives and Sealants	12
2893	Printing Ink	8
2895	Carbon Black	1
2899	Chemical Preparations, N.E.C.	32

Source: Battelle ranking program.

Constructing the Chemical Composition Matrix

After having identified the most likely candidate products, it is necessary to convert them to the chemical constituents. This involves preparation of a matrix as shown in Figure 7. For each product that is listed as a candidate, it is necessary to list the chemical components of which the product is composed. These chemicals can be compared with other high ranked product chemical components to determine whether or not there are cumulative effects over a number of product lines.

The difficulty in completing this phase is that the identification of data for the subject product may be difficult and may require reference to a specialist in the field that produces the product.

To assess the difficulty of collecting this type of information, products in the SIC 2844, Toilet Preparations, were listed and an attempt was made to identify all the chemical components of the subject products.

Table 12 shows the number of chemical constituents of one 4-digit SIC, 2844, Toilet Preparations. For a given product category, there are a large number of possible chemicals that are used in the product in question, and it is possible that additional chemicals may be used from manufacturer to manufacturer. For example, for the product category, Bleaches, Rinses, Dyes, and Tints, there are 30 chemicals used in producing these products, and depending on the manufacturer and type of product specifically, it is possible that another 68 chemicals would be used.*

Construction of this matrix is expensive but is not infeasible. The resources and time for this project did not permit the development of the matrix for the top ranked products, and the detail that might be required to describe a given product may be quite high. Table 13 indicates the names of the constituents of one of the products in the SIC 2844.

After the list of products has been developed a toxicologist should be employed to identify those products and components that represent the greatest potential for harm to the user.

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* Detailed chemical constituents are available from a variety of sources. Refer to bibliography items (1), (2), (3), (18), (19), (20), and (24) for those used for SIC 2844.

TABLE 12. PRODUCTS AND CHEMICALS IN SIC 2844 (TOILET PREPARATIONS)

SIC Number	Name	No. of Chemicals	No. of Other Possible Chemicals
28441-33	Shaving Soap & Cream (Tubes & Jars)	17	
28441-37	Shaving Soap & Cream (Aerosols)	4	
28441-41	Shaving Soap & Cream (Stick, Powder or Cake)	4	
28441-56	Aftershave Preparations	4	4
28441-59	Other Aftershave Preparations	2	
28442-11	Perfume Oil Mixtures & Blends	2	121
28443-13	Soap Shampoos	17	13
28443-21	Hair Tonics (Including Hair & Scalp Conditioners)	28	8
28443-36	Home Permanents	6	10
28443-39	Commercial Permanents	12	10
28443-41	Hair Dressings	5	31
28443-51	Bleaches, Rinses, Dyes & Tints	30	68
28443-63	Hair Spray	22	
28444-11&31	Toothpaste & Toothpowder	14	40
28444-51	Denture Cleaners	6	21
28444-73	Mouthwashes & Rinses	8	8
28444-75	Breath Fresheners	6	
28444-98	Other Oral Hygiene Products	9	
28445-11	Cleansing Creams	6	15

TABLE 12. (Continued)

SIC Number	Name	No. of Chemicals	No. of Other Possible Chemicals
28445-12	Foundation Creams	3	16
28445-13	Hormone Creams	19	19
28445-14	Other Creams	19	10
28445-15	Suntan Oils	11	20
28445-16	Cleansing Lotions	5	11
28445-17	Baby Oils	9	7
28445-18	Hand Lotions	5	7
28445-21	Lip Preparations	51	7
28445-22	Blushers	6	
28445-23	Eye Preparations	34	16
28445-27	Aerosol Underarm Deodorants	45	
28445-29	Feminine Hygiene Deodorants	11	13
28445-31	Nail Lacquers & Enamels	21	19
28445-33	Nail Lacquer Removers	18	7
28445-39	Other Manicuring Preparations	6	6
28445-43&45	Face Powder (Liquid & Compact)	9	23
28445-48	Other Powders	24	21
28445-61	Bath Salts, Oils & Bubble Bath	29	16
28445-98	Other Cosmetics & Toilet Preparations	17	11

Source: References (1), (2), (3), (18), (19), (20), and (24) in bibliography.

TABLE 13. CHEMICAL CONSTITUENTS OF HOME PERMANENTS
PRODUCT CODE 28443-36

Chemicals	Other Possible Chemicals
Ammonia	Borax
Thioglycolic Acid	Sodium Perborate
Monolthanol Amine	Hydrogen Peroxide
Deisopropanol Amine	Thioglycerol and Derivatives
Urea	Polystyrene Latex
Ammonium Thioglycolate	Dimethyl Polysiloxane
	Acrylic Acid Copolymer
	Sodium Lauryl Sulfate
	Sulfated Cetyl Alcohol

Source: Battelle estimates.

Limitations of the Results

Application to Other Pollutant Categories

The approach is useful in identifying products of concern as candidates for future toxic substance problems. In applying the approach for all future pollution problems, it would be necessary to perform the preliminary screening to identify those SIC's that represent good candidates for generation of pollutants of other types. The screening that was done to identify the 2800's as the set of 4-digit SIC's for consideration would have to be done with other pollutants providing the basis for ranking.

Application to Toxic Substance Pollutants

There are other problems that would have to be addressed before the approach were applied comprehensively. It would be useful to calculate the mean (and perhaps other statistical measures) of the normalized data for each of the parameters so that an evaluation of the score could be made. In the case of the historical growth, the normalized numbers are not evenly distributed about the mean. This is due partly to the characteristics of the data and the method of normalizing. A normal distribution about a mean should not be expected for input data distributions and, thus, should not be expected in the normalized index unless special effort is devoted to insuring that numbers be distributed to produce a mean and standard deviation that approximates a normal distribution.

Some of the unevenness in the normalized numbers can be accommodated by designing the model for calculating the normalized numbers to drop (or treat in a special way) numbers that fall at the extremes of the range. For example, all numbers that fall above two standard deviations above the mean of the data in the vector might be assigned a number of 1.0, arbitrarily. Similarly those numbers in the distribution that fall two standard deviations below the mean might be assigned a value of 0.0.

Thus, the bulk of the data will be assigned more appropriate normalized values, not skewed by data at the extremes of the data set.

Another limitation derives from the characteristics of the data that are used in the calculation of the value index. These data are available either in dollar value of shipments or in the physical quantity of the shipments. The problem is that the dollar value of the shipments does not reflect the relative volume of materials that are exchanged. Also, the quantity of shipments data are presented in differing units (lbs., gals., tons, cubic ft., etc.) and as a result are not comparable.

There is probably no simple solution to the quantity problem. In particular, it would be very expensive to attempt to convert all quantity to common units. If this were done, and all products were expressed in tons, conversion factors would have to be identified and applied to all products not expressed in tons. Another choice is to utilize the dollar value of shipments as a proxy for the physical quantity of a product. Use of this variable is based on the weak assumption that quantity and value correlate well, but for very high quantity products it provides a measure of the relative volume and economic importance of the product that is exchanged in the marketplace.

Credibility of the Ranking

The utility and believability of the results of the ranking depends on the credibility of the weights that are established based on judgment. Because of this, objections may be raised regarding the appropriateness of the numbers that are used. To improve these numbers, the group that establishes the weights may be constituted of a sample of knowledgeable persons in the field of potential future pollution problems drawn from a wider base than the group that was used to rank the subject parameters. Second, the use of the parameters in the ranking of products suggests that maintaining high weights for both historical growth and for future growth may result in over-emphasis on the growth of the product as a factor in determining the importance of the product. Thus, weights for one or both of these factors may be reduced. Third, the sensitivity of the ranking should be tested for changes in the weights of the ranking parameters. Finally, there is a feedback to the credibility of the weights that derives from the adequacy of the input data. If the input data do not skew the distribution of the normalized indices then the combination of the factors in the composite index is more acceptable because items in a given percentile will compare more readily with items in a similar percentile for another parameter.

With regard to input data, the quality of the data may vary from parameter to parameter. Because of this, the weights that are assigned may be partially conditioned on the quality of the data. Even for a given parameter, the quality of the data from product to product may vary significantly. Because of this, one suggestion to improve the credibility of the weighting is to assign explicit weights to reflect the quality of the underlying data. For example, for data on the value of shipments from the Census, the completeness of the data varies from product to product. Depending on the dates for which the data are complete, a different modifier might be assigned to the weight that is attached to the parameter. For data that are very current and complete, the assigned weight might take on its full value but for data that are available only for a limited time period, and perhaps not current, the assigned weight might take on a lower value. This suggested modification to the weighting scheme could be applied to all parameters and would improve the credibility of the results.

Although there are limitations in the application of the methodology, the overall results show that the methodology is operational and can be expanded to cover more products. The approach contains the requisite elements of being futuristic, comprehensive, and systematic. The systematic characteristic permits the results to be reviewed and the underlying assumptions to be challenged so that additional resources can be applied to further improve the approach.

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APPENDIX A

PREVIEWS 85

BRIEF DESCRIPTION OF BATTELLE'S INTEGRATED FORECASTING MODEL OF THE UNITED STATES ECONOMY

PREVIEWS 85 is a program of economic forecasting and assistance in long-term planning that Battelle's Columbus Laboratories (BCL) offers the business community. This program is built around a unique, integrated economic forecasting model of the United States that was constructed as part of the Aids to Corporate Thinking program (ACT) at BCL during the interval 1964-73. Since this model is centered on an input-output table, some knowledge of input-output (I/O) nomenclature is required to understand it. We assume that the reader has or can obtain this knowledge*.

Between 1964 and 1972, BCL was engaged in the first four phases of the ACT program. The economic research progressed through four phases designed to project the U.S. economy to 1975, with a base (reference) year of 1960:

ACT I examined and provided forecasts for the consumer sector.

ACT II examined the industrial sector, adopting and developing the input-output (I/O) technique as its fundamental methodology.

ACT III studied and made forecasts of government expenditures.

ACT IV concentrated on making improvements and refinements in I/O techniques.

In addition, while the previous phases of ACT had projected the economy only to 1975, ACT IV began extending these forecasts to 1980 and 1985 and began enlarging the number of industrial sectors in the model from 82 to 130.

The ACT program resulted in several methodological innovations and improvements in I/O techniques. Among the more important are

- A method for better estimating the impact of technology on the economy.
- A method for incorporating price effects into the I/O framework.

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* Readers who are unfamiliar with I/O terminology are referred to A Businessman's Introduction to Input-Output, obtainable upon request from BCL.

- The development of a data base which "strips out" certain artificial and misleading entries characteristic of government I/O data.
- The extension of I/O applications toward the projection of trends in sector profitability.
- The development of an entirely new set of data (the balanced-expansion capital coefficients matrix) to deal with the capital goods sector, a sector usually treated only superficially in conventional I/O analyses. This research, conducted in conjunction with SCIENTIFIC AMERICAN, was made available to ACT sponsors.

The results provided to ACT sponsors were of two kinds: (1) projections and analyses based on special insights provided by the research and (2) the models and data, per se, for the sponsors' own use.

Concurrent with the ACT program, Battelle conducted numerous other economic research activities. Key advances were made in economic simulation models, particularly models tying together economic and demographic variables*. An outgrowth of this work was the development of new computer languages or programming formats that improved the efficiency of building economic models.

ACT V, ending in March 1973, integrated the results of all previous efforts into a new and expanded model that, from a base year in 1970, forecasts the U.S. economy for 5-year intervals out to 1985. The resultant economic forecasting tool, which became the basis of the PREVIEWS 85 program, will be described in the following pages.

PHILOSOPHICAL BACKGROUND

Every forecast or forecasting model is a result of the philosophical attitude of its creators. Therefore, before anyone can fully comprehend or evaluate the usefulness of the ACT/PREVIEWS model, he must at least be aware of the point of view or philosophy which governed the approach, the selection of methodologies, and the choices that were made whenever the research team faced alternative paths. At this point, we briefly sketch out this philosophy in terms of four main areas of consideration: our view of the "future", our conception of the role played by forecasts, our attitude toward simulation as an aid to decision making, and our conception as to how a "global" model of this sort should be organized.

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* See, for instance, Systems Simulation for Regional Analysis, Hamilton, et al., M.I.T. Press, 1969, for a comprehensive treatment of the basic concepts involved. These concepts have been refined and extended in subsequent studies.

A View of the Future

PREVIEWS 85 has as its stated purpose acquainting the corporate planner with the socioeconomic environment of the longer term future. The conception of "socioeconomic environment" makes explicit the fact that social or political forces outside the usual definition of "economic" are taken into account. Any forward look of necessity must be selective; our particular selection of noneconomic factors to be included in this future environment has been made in terms of two criteria: technological relevance and continuity with the present and recent past. Suppose we examine them.

Technological Relevance

Technology may be defined as human uses of resources to change or influence the environment. This is a somewhat broader concept than that usually applied, especially when we include society as part of the environment and institutions as part of technology. Nevertheless, we are convinced of the relevancy and usefulness of this conception, mainly because the same resources (human effort, energy, natural resources, and accumulated capital) will enter into both the core technology, as usually defined, and technology as more extensively defined here.

Battelle, as a broad-spectrum scientific research laboratory, may be said to be in the "technology business". Much of its total research effort is directed toward actually shaping the technologies of the future, and probably all the rest is directed toward better understanding the implications of those technologies and their impacts on people and organizations. Technology therefore cannot be taken for granted by Battelle. It is a matter of interest and of focused attention. This fact has directly influenced our forecasting methodology.

For example, the so-called "_ex_ _ante_" approach to the forecasting of input-output coefficients has been designed for the explicit purpose of taking fullest account of the impacts of technological change on interindustry relationships. There are several different ways of establishing a matrix of direct technical coefficients that presumably reflects target-year technologies:

1. A matrix from a past year can be assumed to describe the future year without further change.
2. A matrix for a past year can be assumed to describe the future year after adjustments for relative price changes.
3. For a selected group of coefficients assumed likely to undergo technological change, technological forecasts can be made, and all other coefficients conformed to them.

4. Estimates can be made of the marginal dollar totals (total intermediate output, and total intermediate input) for every productive sector. Then the dollar flows can be adjusted by means of a double-proportionality method (RAS) to conform to the new marginal values; and new coefficients can be derived.

5. An extrapolation into the future can be made by standard econometric methods, if comparable coefficient matrices are available for two or more past years.

6. A technological forecast to one or more target years can be made for each sector in the I/O table and converted into coefficient form.

Each of these six methods has been used by some group or agency interested in making I/O forecasts. The first three are probably the ones used most often; some examples, but relatively few, of the next two have come to our attention; but, to the best of our knowledge, only Battelle-Columbus has consistently and systematically used the sixth one. A brief discussion of the philosophy guiding our choice of this sixth approach is in order.

The Ex Ante Approach. It is generally agreed that the post-World War II period has been one of rapid technological change, one in which new processes and materials have been adopted, new technical substitutions have been made feasible, and new interindustry markets have emerged. Because of this, the earlier thesis of unchanging or very slowly changing technical coefficients has come under attack. Certainly, to the extent that technological change has speeded up, it is now less likely than ever before that past coefficients will characterize future production, and that past markets (defined in seller/buyer terms) will be unchanged in the future. Battelle, as a contract research organization, is engaged at least partially in shaping the technology of the future. In choosing an I/O forecasting method, it has consciously sought one sensitive to the technology of the future. For long-term forecasts, therefore, Battelle decided to use a methodology that did not force the future to adhere to the interindustry patterns of the past--that is, it decided to adopt a method which would both allow old buyer/seller relations to change or disappear and would allow new buyer/seller relationships (never experienced in the past) to emerge.

The adoption of this criterion automatically removed from consideration every method of projecting the direct coefficients matrix which forced the target-year matrix to duplicate the same cell-density pattern (i.e., pattern of nonzero values) observed in past years. In other words, whether or not new nonzero cells would in fact emerge, the forecasting methodology should not preclude the possibility of such an emergence. This meant that Battelle could not depend solely on any one or more of the first five of the six methods listed, but only on the sixth. At the same time, as long as the controlling criterion was not violated, the other five methods could be used for intermediate or preliminary forecasts.

The forecasting methodology which has resulted from this decision is a multistage, Bayesian method which we have designated "the ex ante" approach to forecasting interindustry relationships. In general, the method consists of generating a preliminary matrix of direct coefficients for each target year, using whatever method or combination of methods (from the first five in the list) is feasible. These preliminary coefficients are then subject to intensive cell-by-cell review by members of a group of experts, the selection of whom is crucial to the effectiveness of the approach. Then the more final coefficient values are established and normalized. A more detailed discussion of the ex ante approach can be provided any sponsor desiring it. The most important consideration is that this method does everything that can be done by any other method currently employed in forecasting I/O coefficients, plus one thing more: It utilizes expert judgment as to the likelihood that profound changes in interindustry relationships will occur because of new technological developments.

Continuity

When we say that "continuity with the present and recent past" is one of our criteria for selecting the parts of our model, we are not implying that the future is a static continuation of the present. Rather, we are saying that there is an orderly process of change which must take place over time. While discontinuities may be possible, true discontinuities in aggregate human affairs are so rare as to be of negligible significance. What Drucker and others have termed "discontinuities" are actually slight speedings-up of the pace of change--their "discontinuities" all prove to involve change, not abrupt substitutions of one situation for another. Granted, the closer we come to the individual, the more likely it is that his life can be revolutionized or terminated by a sudden event. But that event had been evolving elsewhere in the scheme of things. It would be a "discontinuity" only because of limited vision.

In other words, to be meaningful, a description of the future must be able to answer the question, "How can you get there from here?" This is especially true of a description of future technology. Technology evolves from the laboratory to the pilot plant to gradual embodiment into plant-and-equipment. It must "gestate and be born". During the six or more years we have been using the ex ante approach, the ACT team interviewed and worked with hundreds of experts in industrial technology. This experience has led to an important generalization:

The technological developments that are likely to influence the 10-or 12-year future are already under way in research laboratories and pilot plants. The length of this gestation period is such, therefore, that *ex ante* forecasts for a 10- or 12-year future can be made with little need to fear "surprises", or unexpected breakthroughs. Forecasts for futures longer than 10 to 12 years, however, are in serious danger of being disturbed by surprises.

Applying this generalization to the PREVIEWS model (developed in the 2-year period 1971-1972) leads to the conclusion that we can have a high degree of confidence in the technological forecasts which support our I/O coefficients out to 1980. By 1985, however, there is so much room for surprises that this confidence must be significantly qualified. For that reason, after a lapse of about five years, we plan to make new, more nearly final forecasts for 1985 and extend the forecasts to 1990 on a preliminary basis.

It should also be pointed out that, in the interest of continuity, we are careful to select experts who combine clear understanding of both the scientific possibilities and the business decisions that will shape future technologies. As we have often said, we are interested in forecasting future business realities, not in writing science fiction.

The Purpose of Forecasts

In framing PREVIEWS we have been governed by a very specific conception of the purpose which must be served by any *long-term* forecast. Before stating it, however, it will be useful to examine the difference between long and short futures, from the standpoint of the forecaster.

As we see it, the short term future--that is, the next year or two--has already been largely "committed" by acts already performed and by decisions already made. There is relatively little freedom for decisions not yet made to profoundly influence it, particularly at the more aggregate levels of macroeconomic events. Therefore, a short term forecasting model should be evaluated mainly in terms of its ability to *predict*, that is, to describe what that future will look like when it arrives. It follows that the validity of a short term model can be fairly determined by comparing its forecasts with subsequent realities.

Long term futures (beyond five years, especially) are not committed to anything like the same degree. Decisions which are yet to be made, which will be made at least in part by users of long term forecasts, will have profound influence on the long term future. Thus, the forecast itself is not and cannot be a *prediction*, but is at best a *projection*. It must be viewed as a judgmental extension of forces which are known to operate or to have operated into a future in which they will not necessarily be dominant. While the long term forecaster is naturally gratified when his projections are borne out by events, it must be recognized as good fortune, not as proof of excellence.

We view the long term forecast as an aid to decision making. In our model we have brought together "best judgments" concerning the likely future and have quantified them to the best of our ability. We have used the best data and the most precise methods available. But we have done this all with the full knowledge that any long term forecast is far more a judgment than a prediction. Therefore, our ex ante method is a device for explicitly eliciting, controlling, checking, quantifying, and integrating expert judgments about the future.

Simulations

As a logical extension of our philosophical view of the long term future, it follows that this model should be flexible in its capability to change with new or different judgments concerning forces affecting that future. In other words, the model ought to allow the working out of the implications of quite different judgments from those which we used. For instance, it is our best judgment that a particular set of assumptions concerning future fertility should be incorporated into the demographic part of the model. We cannot prove that these assumptions will, in fact, control the future. Therefore, we have built the model so that an alternative set of fertility assumptions can be substituted and their implications quantified thereby. To the best of our capability and resources, we have done this throughout the model.

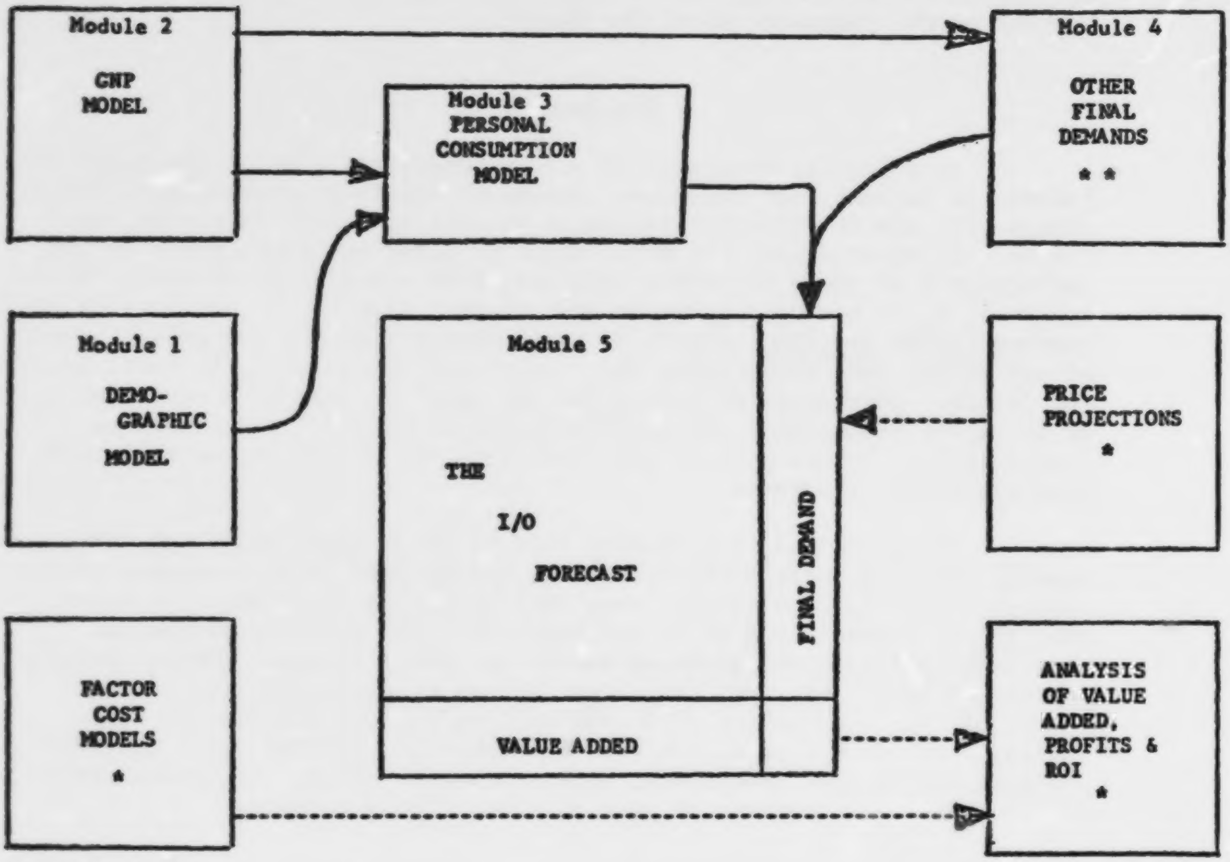
There are many alternative sets of assumptions which may be equally likely to affect the future, in the opinion of any business or public policy decision maker. When this is the case, prudence dictates that all be taken into account and that the final decision be the one that looks best for the greatest number of likely futures. Thus, decision making can be greatly facilitated by the use of simulation, by asking the model "but what if - - - -?" and working out the alternative implications. At every step in its construction, the PREVIEWS model has been designed for optimal flexibility as a simulation model. As we work with it, we will try to improve it even further in this respect.

PREVIEWS Model Structure

As presently constructed, with some consideration of elements which have not been undertaken, the model is presented schematically in the accompanying figure. It will be noticed that there are five numbered components, or "modules", as well as three unnumbered modules connected to the rest of the model by broken arrows. The numbered modules are now operational, though not necessarily in their ultimately final form; the other three are not, but will be added soon. At this point, we wish to discuss this model in terms of its broad characteristics.

The research of ACT V was predicated on the belief that a comprehensive forecasting model is needed that takes into account the interaction among three fundamental forces in our economy. These forces are:

THE BATTELLE-COLUMBUS ECONOMIC FORECASTING MODEL


Module 2
GNP MODEL
Module 3
PERSONAL CONSUMPTION MODEL
Module 4
OTHER FINAL DEMANDS
* *
Module 1
DEMO-GRAPHIC MODEL
Module 5
THE I/O FORECAST
FINAL DEMAND
VALUE ADDED
PRICE PROJECTIONS
*
FACTOR COST MODELS
*
ANALYSIS OF VALUE ADDED, PROFITS & ROI
*

* To be added.

** To be replaced by dynamic estimating modules for each separate final demand.

1. Demography--The changing structure of our population will have a significant impact on both the growth of the total economy and the nature of the products purchased.

2. Consumer behavior--Rising incomes will alter many spending patterns from what they have been in the past.

3. Technological change--New technology will continue to have a significant impact both on what products are demanded and how they will be produced.

We have selected those variables that are important relative to each of the above factors, and integrated them into a comprehensive model of the U.S. economy which also includes variables affecting aggregate GNP and other final demands beside those of the consumer. This model is capable of making detailed forecasts of population, consumer spending, and the output of various industries. An analysis of the nature and significance of each of these three forces follows, along with discussions of the other model elements.

Demographic Structure

Two significant developments have shaped the postwar structure of the U.S. population. First, the highly publicized baby-boom following World War II produced a well-defined "ripple" or "bulge" in the population age structure. Table 1 shows how the growth of various age groups changed between 1950 and 1970.

TABLE 1. GROWTH RATES BY AGE-CLASS OF U.S. POPULATION, 1950-1970

	Age Classes (Average Annual Percent Change)						
Years	Under 25	25-34	35-44	45-54	55-64	Over 65	Total
1950-1960	2.44	-0.48	1.13	1.66	1.55	3.02	1.72
1960-1970	1.58	0.98	-0.46	1.24	1.79	1.91	1.26
			All Races, All Sexes Numbers (Thousands)				
1950*	63,353	24,036	21,637	17,453	13,396	12,397	152,271
1960**	80,652	22,918	24,221	20,572	15,621	16,685	180,667
1970**	94,326	25,278	23,126	23,269	18,648	20,156	204,800

* Source: Current Population Reports; Population Estimates, Series P-25, No. 311, July 2, 1965, pp. 22-23, U.S. Department of Commerce, Bureau of Census.

** Source: Current Population Reports, Population Estimates and Projections, Series P-25, No. 476, February 1972, p. 13.

In the 1950's the "ripple" affected the youngest age groups, e.g., persons under 10 years of age. This produced a strong demand for products and services directed at this age group. To give one example, demands on elementary schools were heavy and teacher shortages developed during that period. Then, during the 1960's, the "postwar babies" reached their teens and produced, among other things, heavy demands for secondary and college educational systems. By the late 1960's, this group was beginning to marry, significantly increasing rates of family formation. This family formation boom will continue into the early 1970's and will lead to continued higher levels of demand for products associated with new households, e.g., housing and furniture.

In the 1960's a second important variable emerged. The birth rate began to fall. Thus, while family formation was up significantly in the latter part of the 1960's, the new families were having relatively fewer children. Thus, the 1970's find us with a significantly higher portion of heads of households that are in the younger age brackets but who have fewer than the historical number of children. Families are getting smaller.

It is our contention that these important trends--changing relations in the age structure, declining family sizes, and falling birth rates--should all be considered when forecasting trends in consumer spending and in industry growth. These demographic factors usually are discussed in the literature in terms of their more obvious implications for such products as baby foods, but we believe that they also have important, though often subtle and indirect impacts on many industrial products, such as steel and aluminum. These demographic factors are explicitly introduced in Module 1.

Gross National Product

In order to take account both of historical trends in aggregate productivity and demands as well as of the demographic and consumer related forces affecting the future, a special GNP submodel (Module 2) has been devised. This module operates both on its own internal (endogenous) forces and on feedback from the population and consumption modules. In order to generate some initial values for GNP and its components, this portion of the model operates at a highly aggregative level to convert trends in the population of working ages, in real productivity, and in the main components of GNP into projections of real income and output under assumptions of full resource employment. The trends in three of these variables are shown in Table 2.

Notice that real GNP per person of working age (i.e., real productivity) increased during this entire period at a relatively uniform 2.5 percent per year rate. The working age group, however, increased twice as rapidly during the 1960's as during the 1950's, a direct result of the population "bulge" discussed above. The ratio of real personal consumption to GNP held essentially steady during the 1950's and rose during the 1960's. As we can demonstrate, this upward trend has been partly reversed by other considerations in our projections to 1985.

TABLE 2. TRENDS IN GNP AGGREGATES, 1950-1970

Year	Real GNP per Worker*	Working Population*	PCE as Percent of GNP
1950	$5,190	92,597,000	64.9
1960	6,634	99,464,000	64.8
1970	8,474	114,944,000	66.1
	Growth Rates (Percent per Year)		
1950-1960	2.5	0.7	
1960-1970	2.5	1.5	

Sources: Bureau of the Census and Bureau of Economic Analysis

* The working population (whether or not in the labor force) is defined here as all persons 18 through 64 years of age. Real GNP is expressed in constant 1970 dollars.

Consumer Spending and the Consumer Profile

How consumer spending varies with income is a much discussed and analyzed subject. An analysis of such shifts is an obvious requirement for inclusion in any comprehensive economic forecasting model. However, as previously discussed, we also feel it is necessary to include analysis of how expenditures change by household--the basic spending unit--as the age of the head of the household and the family size change. These analyses take on increased importance because the proportions of the population in each age group is changing at the same time that average family size has been falling. Considerations of this kind are dealt with by Module 3.

One hypothesis we have formulated is that the economy might experience a double-barreled increase in discretionary income resulting from a simultaneous rise in family income and a drop in family size. This would be brought about first by the well known phenomenon that increasing incomes would allow less and less to be devoted to necessities and more devoted to discretionary items. While the family size consideration is less well understood and discussed, it seems apparent that two families with about the same income, but with a different number of children, will tend to spend their income differently. The smaller families can be assumed to have more discretionary income, all other things being equal. Thus, future discretionary incomes may rise more than a structurally historical extrapolation might indicate. Such an acceleration in discretionary income and related expenditures probably would favor products and services directed toward the amenities rather than the necessities.

Table 3 lists the family characteristics in terms of which forecasts or simulations can be made. Not only can changes be made directly in terms of these classes and their behavior, but changes can also be made in terms of the behavior of other characteristics (e.g., race, tenure status, education of head) and fed directly into the model through the listed characteristics. In connection with the income-behavior classes, attention is called to the fact that each class will have different, rather than fixed income limits in each year. In parentheses we show the 1950 income class most similar in behavior to the given income-behavior class. In 1970, however, each such class received higher incomes than those shown.

TABLE 3. BASIC FAMILY CHARACTERISTICS USED IN THE CONSUMPTION MODULE

Age of Head	Number of Persons in Family	Income-Behavior Class (1960 Income per Family)
Under 25 years	1 person	I (under $3,000)
25-34	2 persons	II ($3,000-3,999)
35-44	3 persons	III ($4,000-4,999)
45-54	4 persons	IV ($5,000-5,999)
55-64	5 persons	V ($6,000-7,499)
65 and over	6 or more	VI ($7,500-9,999)
		VII ($10,000-14,999)
		VIII ($15,000 and over)

For each of the 48 family size-and-income classes in any year, our consumer behavior equations forecast expenditures for each of 42 classes of consumer's goods and services. These are listed in Table 4. We also break down each of these 42 classes into finer classes, for a total of 180 consumption items altogether, before feeding them into our input-output model (Module 5).

TABLE 4. THE BROAD CATEGORIES OF CONSUMPTION FOR WHICH EXPENDITURES BY FAMILY CLASS ARE PROJECTED

Food prepared at home
Food away from home
Tobacco
Alcoholic beverages
Rented dwellings
Owned dwellings, owned vacation homes, and other owned real estate
Lodging out of home city
Fuel, light, refrigeration, and water
Household operation
Household textiles
Furniture
Floor covering
Appliances
Miscellaneous household items
Other housewares
Men's and boys' outerwear
Men's and boys' underwear, nightwear and socks
Men's and boys' footwear
Men's and boys' hats, gloves and accessories
Women's and girls' outerwear
Women's and girls' underwear and nightwear
Women's and girls' hosiery
Women's and girls' footwear
Women's and girls' hats, gloves and accessories
Clothing, children under two years
Automobile purchase
Automobile operation
Other travel and transportation
Prepaid medical care
Direct-expense medical care
Personal care services
Personal care supplies
Audio-visual home recreation
Spectator admissions
Other recreation
Reading material
Education
Clothing materials (hard goods, notions, etc.)
Personal insurance
Gifts and contributions (as value)
Miscellaneous tours, etc.
Clothing services.

Other Final Demands

Although, as indicated by the last column in Table 2, consumer expenditures (PCE) constitute about two-thirds of total final demand, changes in the forces affecting the other elements can have significant influence on the economy. As presently established, Module 4 operates primarily by the application of historical trend factors and structural distributions that have characterized these other final markets. In the immediate future, however, we hope to replace parts of this module with new modules that will generate these other components of GNP in terms of their own cause-effect relationships.

As they feed into the I/O submodel (Module 5) these other final demands embrace the markets provided by investment (both in plant-and-equipment and in inventory); by governmental expenditures at the federal, state and local levels; and by foreign trade. In the latter case, the demand for U.S. products that is generated by our exports must be offset against the satisfaction of U.S. demands by the importation of competitive foreign goods and services.

During subsequent research programs we intend to substitute new modules for the present Module 4, beginning probably with the addition of a capital matrix and an inventory model. These two new elements, by themselves, will greatly enhance the dynamic effectiveness of the overall model.

Industry Profile

In addition to consumer spending trends and demographic influences technology is an extremely important determinant of the kinds of products that will be demanded and the ways in which they will be produced. As technology changes, it exerts immediate and important influence on the growth and decline of specific economic sectors. Some industries will begin to produce new and improved products, thereby spurring demands for their output. Technological change often alters the processes by which various products are made, thus placing new and different demands on a wide range of suppliers.

In generating any set of industry forecasts, not only must one consider the final market demands created by the consumer, by investors, by government, and by export markets, one must also consider the demands of other industries. For many industries, such as steel, these so-called "intermediate demands" are far more important than the "final demands" of the consumer. It is our contention that any attempt to forecast levels of future economic activity must take into account all demands upon each industry, not just those of consumers, government and other final markets. In particular, interindustry demands must be considered, and, in considering them the role of technology must be explicitly recognized.

The 127 industrial sectors for which this model forecasts technology and market profiles are listed in Table 5.

TABLE 5. INDUSTRY PROJECTIONS

Agriculture, Forestry, and Fishery

Livestock, and livestock products
Field and orchard crops
Forestry and fishery products
Services to agriculture, forestry, and fishery

Extraction of Mineral Resources

Iron and ferroalloys ores
Copper ores
Nonferrous ores, except copper
Coal
Crude petroleum and natural gas
Stone and clays
Chemical and fertilizer minerals

Manufacture of Food, Leather, and Textile Products

Food and kindred products
Tobacco manufactures
Leather tanning and industrial leather products
Footwear and other leather products
Fabrics, yarns, and threads
Soft floor coverings
Tire cord and miscellaneous textile goods
Knitted apparel
Apparel made from purchased materials
Miscellaneous fabricated textile products

Wood and Paper Products

Sawmills and planing mills
Veneer and plywood
All other lumber and wood products, except containers
Wooden containers
Household furniture
Other furniture and fixtures
Pulp, paper and paper products, except containers
Paperboard containers and boxes

Petroleum and Chemical Products

Petroleum refining and related products
Paving mixtures and asphalt products

TABLE 5. (Continued)

Petroleum and Chemical Products (Continued)

Industrial inorganic and organic chemicals
Fertilizers
Agricultural chemicals, except fertilizers
Miscellaneous chemical products
Plastics materials, resins, and synthetic rubber
Organic manmade fibers
Cleaning preparations
Drugs
Toilet preparations
Paints and allied products
Tires and innertubes
All other rubber products
Manufactured plastics products

Stone, Clay, and Glass Products

Glass and glass products
Hydraulic cement, lime, and gypsum products
Clay and cement products, and refractories
All other stone and nonmetallic mineral products

Primary Metals and Manufactures

Primary iron and steel
Primary copper
Primary aluminum
All other primary nonferrous metals

Fabricated Metal Products

Metal cans
Metal barrels, drums, and pails
Metal sanitary ware and plumbing fittings
Nonelectric heating equipment
Fabricated structural metal products
Screw machine products, etc., and stampings
Other fabricated metal products

General Machinery and Components

Engines and turbines
General industrial machinery and equipment
Machine-shop products

Specialized Machinery

Farm machinery
Construction machinery
Mining machinery

TABLE 5. (Continued)

Specialized Machinery (Continued)

Oil-field machinery
Materials-handling machinery, except trucks
Industrial trucks and tractors
Metalworking machinery
Special industry machinery

Transportation Equipment

Motor vehicles and parts
Aircraft and parts
Ship and boat building and repair
Locomotives and rail and street cars
Motorcycles, bicycles, trailer coaches, etc.

General Electrical Apparatus

Electrical measuring instruments
Electric motors and generators
Industrial controls transformers, etc.
Electric lamps
Lighting fixtures and wiring devices
Electronic components and accessories
Miscellaneous electrical machinery

Special Electrical Apparatus

Service industry machinery
Household appliances
Radio, television, and communications equipment

Scientific and Measuring Devices

Scientific instruments, measures, and controls
Medical, surgical, dental instruments, and supplies
Watches, clocks, and parts
Optical and ophthalmic goods
Photographic equipment and supplies

Business Machines and Supplies

Computing and related machines
All other office and business machines
Office supplies

Miscellaneous Manufactures

Ordnance and accessories
Other miscellaneous products

TABLE 5. (Continued)

Transportation

- Railroads and related services
- Local and other highway passenger transport
- Motor freight and warehousing
- Water transportation
- Air transport
- Pipe lines
- Transportation services

Public Utilities

- Telecommunication
- Electric power
- Gas
- Water services
- Sanitary services

Construction

- New construction, nonfarm residences
- New construction, nonresidential buildings
- New construction, public utility
- New construction, highway and other
- Maintenance and repair construction

Trade and Business Services

- Wholesale and retail trade
- Finance and insurance
- Real estate and rental
- Advertising
- Other business and professional services
- Business travel, entertainment, and gifts

Other Services

- Printing and publishing
- Radio and television broadcasting
- Hotels and lodging places
- Personal and repair services, except auto
- Automobile repair and services
- Amusements
- Medical and health services
- Educational services and nonprofit organizations

Government Enterprise

- Post Office

APPENDIX B

VALUE OF SHIPMENTS

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VALUE OF SHIPMENTS OF PRODUCTS

1972 PRODUCT CODE	UNIT OF MEASURE	TOTAL GROWTH RATE	1972 VALUE (MIL $)	GROWTH RATE	1967 VALUE (MIL $)	GROWTH RATE	1963 VALUE (MIL $)	GROWTH RATE	1958 VALUE (MIL $)
28219 13	MILLION LBS	.8689			6.1	.8689	0.5		
28199 93	MILLION DOL	.3695			171.7	.9531	11.5	.0296	10.2
28139 91	THOUSAND TONS	.3549	37.9	.3549	8.3				
28514 21	MILLION GAL	.3355	66.7	.3355	15.7				
28215 11	MILLION LBS	.3074			14.9	.3074	5.1		
28794 71	MILLION LBS	.3029	42.8	.3029	11.4				
28241 33	MILLION LBS	.3019	313.0	.3019	93.7				
28992 51	MILLION LBS	.3019	10.1	.3019	2.7				
28311 11	MILLION DOL	.2795	123.1	.2795	35.9				
28341 43	MILLION DOL	.2689	46.9	.2334	16.1	.3080	5.5		
28213 51	MILLION LBS	.2501			117.7	.2501	48.2		
28315 23	MILLION DOL	.2425	15.1	.2425	5.1				
28914 99	MILLION GAL	.2418	62.3	.2418	21.1				
28511 33	MILLION GAL	.2413	50.4	.2413	17.1				
28347 --	MILLION DOL	.2306	694.7	.1292	378.4	.3704	107.3		
28792 83	MILLION LBS	.2309	401.3	.0993	250.6	.3857	67.8	.2536	21.9
28211 15	MILLION DOL	.2196			25.0	.2196	11.3		
28315 99	MILLION DOL	.2201	7.3	.2201	2.7				
28519 53	MILLION LBS	.2155	19.9	.2155	7.5				
28345 73	MILLION DOL	.2149	58.8	.0930	37.7	.3865	10.2		0.2
28152 99	THOUSAND TONS	.2105	2.9						
28342 95	MILLION DOL	.2092	44.2	.1827	19.1	.2430	8.0		
28345 25	MILLION DOL	.2050	43.4	.3412	10.0	.0541	8.1		
28932 31	MILLION LBS	.2047	79.1	.1398	41.3	.2925	14.9		
28214 99	MILLION LBS	.2038			105.2	.2038	50.1		
28349 45	MILLION DOL	.2544	17.6	.1650	8.2	.2555	3.3		
28445 61	THOUS UNITS	.2331	154.4	.1871	65.5	.1535	37.0	.2611	11.6
28349 11	MILLION DOL	.2023	2.1	.2129	0.8	.1892	0.4		
28347 99	MILLION DOL	.1975	80.0	.3079	20.9	.0724	15.9		
28512 --	MILLION GAL	.1956	225.9	.1126	129.5	.1200	92.3	.3568	17.9
28743 25	THOUSAND TONS	.1952	68.7	.3612	14.7	.0159	13.8		
28513 99	MILLION GAL	.1934	27.0	.0030	26.6	.4830	5.5		
28346 11	MILLION DOL	.1912	152.1	.2558	48.7	.1151	31.5		
28439 71	MILLION LBS	.1909	96.8	.1177	55.5	.1712	29.5	.2856	8.4
28511 34	MILLION GAL	.1881	11.6	.1881	4.9				
28199 73	THOUSAND AV OZ	.1868	14.3	.1719	6.5	.1291	4.0	.2521	1.3
28412 13	MILLION LBS	.1798	85.5	.1325	45.9	.2418	19.3		
28314 11	MILLION DOL	.1788	186.4	.1788	81.9				
28332 61	MILLION DOL	.1775	63.1	.1426	32.4	.2226	14.5		
28445 23	THOUS UNITS	.1753	151.7	.1113	89.5	.2089	41.9	.2154	15.8
28346 17	MILLION DOL	.1735	45.1	.1063	24.2	.2633	9.5		
28343 43	MILLION DOL	.1719	95.5	.1925	39.6	.1467	22.9		
28343 55	MILLION DOL	.1713	44.8	.1834	19.3	.1562	10.8		
28153 93	THOUSAND TONS	.1679	7.9	.2335	2.8	.0621	2.2	.1957	0.9
28711 95	MILLION DOL	.1677			35.7	.1677	19.2		
28213 63	MILLION LBS	.1681			12.1	.1681	6.5		
28516 93	MILLION GAL	.1695	67.0	.0791	46.0	.2922	16.5		
28743 73	THOUSAND TONS	.1565	[illegible]	.1659	5.1	.2498	2.3		

VALUE OF SHIPMENTS OF PRODUCTS

1972 PRODUCT CODE	UNIT OF MEASURE	TOTAL GROWTH RATE	1972 VALUE (MIL $)	GROWTH RATE	1967 VALUE (MIL $)	GROWTH RATE	1963 VALUE (MIL $)	GROWTH RATE	1958 VALUE (MIL $
28211 81	MILLION DOL	.1659			18.1	.1658	9.8		
28347 93	MILLION DOL	.1662	35.1	.1644	16.4	.1684	8.9		
28514 31	MILLION GAL	.1663	21.8	.1663	16.1				
28199 63	THOUSAND TONS	.1646	20.1	.0877	13.2	.2684	5.1		
28213 89	MILLION LBS	.1655			144.1	.1655	78.1		
28332 81	MILLION DOL	.1554	23.0	.3313	5.5	-.0132	5.9		
28348 53	MILLION DOL	.1655	12.3	.2716	3.7	.0452	3.1		
28914 IL	MILLION LBS	.1644	423.2	.1644	197.7				
28995 13	MILLION LBS	.1645	5.9	.0125	5.6	.2359	2.4	.2794	0.7
28346 93	MILLION DOL	.1633	11.7	.4541	1.8	-.1199	3.0		
28215 --	MILLION LBS	.1620			51.6	.1620	28.3		
28211 45	MILLION DOL	.1608			20.7	.1608	11.4		
28242 --	MILLION LBS	.1615	1816.1	.1494	935.3	.1767	472.2		
28349 21	MILLION DOL	.1631	27.4	.1150	15.9	.2190	7.2		
28443 63	MILLION GAL	.1595	276.4	.0623	204.3	.0659	158.3	.3539	34.8
28215 31	MILLION LBS	.1569			12.9	.1569	7.2		
28134 43	MIL CU FT	.1556	130.3	.0552	99.6	.2562	40.0	.1839	17.2
28423 31	MILLION DOL	.1559	167.2	.2103	67.1	.1620	36.9	.1084	22.0
28711 --	MILLION DOL	.1552			1225.5	.1552	688.1		
28342 57	MILLION DOL	.1544	405.3	.1447	216.2	.1667	111.3		
28441 99	THOUS UNITS	.1542	4.6	.1732	1.8	.1310	1.1		
28519 41	MILLION GAL	.1540	63.5	.2453	21.2	.0491	17.5		
29213 71	MILLION LBS	.1529			357.4	.1529	202.3		
28348 25	MILLION DOL	.1524	162.9	.1044	99.1	.2155	45.4		
28517 93	MILLION GAL	.1511	18.8	.0816	12.7	.2442	5.3		
28347 63	MILLION DOL	.1487	[illegible]	.1487	6.4				
28424 13	MILLION DOL	.1486	104.4	.1164	60.2	.1776	31.3	.1585	15.0
29139 23	MILLION DOL	.1482	49.5	.1482	24.3				
28344 33	MILLION DOL	.1476	10.7	.2330	3.8	.0522	3.1		
28791 49	MILLION LBS	.1477	149.7	.0243	125.6	.1994	60.7	.2296	21.6
28516 33	MILLION GAL	.1473	16.3	.1473	8.2				
28516 42	MILLION GAL	.1468	30.2	.2064	21.9	.2560	8.9		
28518 98	MILLION GAL	.1466	41.4	.0377	34.4	-.0487	42.0	.4709	6.1
28342 51	MILLION DOL	.1460	64.8	.0757	45.0	.2406	19.0		
28341 13	MILLION DOL	.1455	65.2	.0962	41.2	.2103	19.2		
28423 51	MILLION DOL	.1447	29.1	.1447	14.3				
28513 02	MILLION GAL	.1447	68.2	.1447	34.7				
28445 27	MILLION LBS	.1444	362.3	.1442	184.7	.1833	94.3	.1147	54.8
28442 --	MILLION GAL	.1429	673.6	.1117	394.9	.1730	208.6	.1507	103.4
28442 11	MILLION GAL	.1432	659.0	.1161	380.5	.1686	204.0	.1505	101.2
28914 [illegible]	MILLION GAL	.1415	66.1	.1415	34.1				
28445 17	THOUS UNITS	.1414	43.3	.2969	12.6	.0393	10.9	.0969	6.8
28312 11	MILLION DOL	.1411	73.5	.1401	36.6				
28343 51	MILLION DOL	.1404	74.3	.1239	44.3	.1626	24.3		
28516 98	MILLION GAL	.1398	69.5	-.0095	72.9	.3586	21.4		
28995 33	MILLION LBS	.1436	45.7	.1606	29.3	.2694	15.9	.0835	7.3
28347 61	MILLION DOL	.1394	137.6	.1349	71.1	.1452	42.5		
28199 15	THOUSAND TONS	.1393	14.1	.1964	8.9	.1582	5.9	.2373	2.3

VALUE OF SHIPMENTS OF PRODUCTS

1972 PRODUCT CODE	UNIT OF MEASURE	TOTAL GROWTH RATE	1972 VALUE (MIL $)	GROWTH RATE	1967 VALUE (MIL $)	GROWTH RATE	1963 VALUE (MIL $)	GROWTH RATE	1958 VALUE (MIL $)
28341 27	MILLION DOL	.1377	123.4	.0192	139.5	.3055	37.7		
29347 17	MILLION DOL	.1372	52.8	.1522	26.0	.1187	16.6		
28411 21	MILLION GAL	.1366	262.4	.1350	139.3	.1043	93.5	.1643	43.7
28445 14	THOUS UNITS	.1346	84.9	.1714	39.5	-.0425	45.8	.2596	14.5
28511 99	MILLION GAL	.1348	41.5	.0488	32.7	.2522	13.3		
28412 93	MILLION LBS	.1344	7.6	-.0226	7.2	.1854	3.9	.2457	1.3
28214 31	MILLION LBS	.1329			111.6	.0954	77.5	.1639	36.3
28914 --	MILLION LBS	.1331	666.0	.1331	356.6				
29136 25	THOUSAND TONS	.1322	47.2	.1993	19.1	.0588	15.2	.1286	8.3
28214 75	MILLION LBS	.1322			42.1	.1322	24.4		
28342 99	MILLION DOL	.1324	74.7	.1472	37.6	.1142	24.4		
28344 13	MILLION DOL	.1348	74.7	.1237	41.7	.1399	24.7		
28995 91	MILLION LBS	.1298	101.5	.0676	73.2	.2122	33.9		
28199 33	THOUSAND TONS	.1280	14.8	.2259	3.9	.1817	2.0	0.0000	2.0
26211 41	MILLION DOL	.1291			11.5	.1281	7.1		
28344 51	MILLION DOL	.1276	34.2	.1487	17.1	.1019	11.6		
28423 61	MILLION DOL	.1282	67.1	.1181	38.4	.0992	26.4	.1632	12.4
28441 56	MILLION GAL	.1292	150.4	.1209	93.0	.2141	42.8	.0901	27.9
28444 73	THOUS UNITS	.1294	118.8	.3074	31.1	.1269	19.7	-.0210	21.9
26791 43	MILLION LBS	.1282	146.2	.0791	99.9	.1374	59.7	.1720	27.0
28211 25	MILLION DOL	.1275			5.3	.0537	4.3	.1903	1.9
28345 31	MILLION DOL	.1266	3.9	.2593	1.2	-.0198	1.3		
28445 19	THOUS UNITS	.1268	41.2	-.0500	58.4	.2735	22.2	.2117	8.5
28512 11	MILLION GAL	.1261	172.2	.1261	95.0				
28342 27	MILLION DOL	.1253	284.2	.0919	191.7	.1820	98.2		
28515 11	MILLION GAL	.1248	54.6	.1248	28.1				
28995 12	MILLION LBS	.1256	30.7	.2701	10.9	.0737	8.2	.0591	5.9
28423 11	MILLION DOL	.1243	46.9	.0994	30.7	.1592	17.0	.1331	9.1
26793 71	MILLION LBS	.1239	26.6	.0919	13.5	.1470	7.9	.1487	3.9
28199 53	THOUSAND TONS	.1232	6.1	.1241	3.4	.1280	2.1	.1194	1.2
28694 11	MILLION DOL	.1232	499.1	.0969	308.2	.0838	223.4	.1535	96.2
28445 22	THOUS UNITS	.1219	23.5	.3612	6.3	.1002	4.3	-.0176	4.7
28163 15	THOUSAND TONS	.1232	24.5	.0363	20.5	.0794	15.1	.2474	5.0
28213 --	MILLION LBS	.1195	3623.1	.1349	1924.8	.1067	1311.5		
28242 51	MILLION LBS	.1197	763.5	.0937	494.6	.1571	275.9		
28411 23	MILLION LBS	.1195	102.2	.1113	60.3	.1299	37.0		
28423 --	MILLION DOL	.1196	892.9	.1093	528.0	.1232	331.7	.1282	181.5
28693 99	MILLION DOL	.1200	6.1	.0365	5.1	.2339	2.2		
28752 17	THOUSAND TONS	.1200	43.8	.0629	32.3	.1957	15.8		
28995 41	MILLION LBS	.1202	34.3	.1428	17.6	.0646	13.7	.1437	7.0
28211 21	MILLION DOL	.1191			188.1	.1049	126.2	.1306	68.3
28516 45	MILLION GAL	.1192	32.0	.1193	17.1				
28915 --	MILLION GAL	.1188	119.7	.1189	68.3				
28933 45	MILLION LBS	.1194	46.1	.1492	23.1	.1569	12.9	.0631	9.5
28311 --	MILLION DOL	.1184	398.3	.1897	167.1	.0746	125.3	.0856	83.1
28411 73	MILLION LBS	.1183	42.1	.1099	25.0	.0917	17.6	.1487	8.8
28444 99	MILLION DOL	.1178	68.9	.0604	51.4	.1509	29.3	.1511	14.5
28211 31	MILLION DOL	.1172			22.9	.1172	14.7		

VALUE OF SHIPMENTS OF PRODUCTS

1972 PRODUCT CODE	UNIT OF MEASURE	TOTAL GROWTH RATE	1972 VALUE (MIL $)	GROWTH RATE	1967 VALUE (MIL $)	GROWTH RATE	1963 VALUE (MIL $)	GROWTH RATE	1958 VALUE (MIL $)
28516 41	MILLION GAL	.1170	43.3	.0983	27.1	.1408	16.0		
28348 61	MILLION DOL	.1160	9.4	.0733	6.6	.1718	3.5		
28343 --	MILLION DOL	.1148	381.9	.1298	207.5	.0964	143.6		
28365 93	MILLION DOL	.1153	29.9	.2714	9.0	-.0532	11.2		
28695 37	MILLION DOL	.1145	22.8	.0297	19.7	-.0158	21.0	.3324	5.0
28193 81	THOUSAND TONS	.1134	19.8	.0749	13.8	.1849	7.0	.0973	4.4
28513 81	MILLION GAL	.1130	31.2	.1502	15.5	.0683	11.9		
28512 96	MILLION LBS	.1131	32.7	.1078	19.6	-.0112	20.5	.2294	7.3
28741 95	THOUSAND TONS	.1131	132.1	.1131	77.3				
28342 73	MILLION DOL	.1122	32.8	.1365	17.3	.0825	12.6		
28411 61	MILLION GAL	.1121	23.9	.0891	15.6	.1709	8.3	.0898	5.4
28512 16	MILLION GAL	.1116	29.7	.1116	17.5				
28519 51	MILLION GAL	.1122	22.8	.1122	13.4				
28635 51	MILLION DOL	.1122	57.6	.0553	44.0	.1892	22.0	.1110	13.0
28792 79	THOUSAND TONS	.1112	18.6	-.0084	19.4	.2812	7.2		
28213 85	MILLION LBS	.1101			68.8	.1101	45.3		
28349 51	MILLION DOL	.1099	2.3	.1390	1.2	.0746	0.9		
28412 15	MILLION GAL	.1099	95.6	.1454	48.5	.0671	37.4		
28413 94	MILLION LBS	.1095	9.0	.0957	5.7	.0926	4.0	.1375	2.1
28445 19	THOUS UNITS	.1102	28.1	.2422	9.5	-.1064	14.9	.1805	6.5
28518 99	MILLION GAL	.1095	12.0	.0085	11.5	.0182	10.7	.3075	2.8
28249 75	MILLION DOL	.1089	131.8	.0243	116.9	.2245	52.0		
28443 41	MILLION GAL	.1086	289.1	.0283	251.4	.0897	178.3	.2116	68.3
28341 17	MILLION DOL	.1078	9.3	.0880	6.1	.1331	3.7		
28342 91	MILLION DOL	.1080	15.1	.0971	9.5	.1217	6.0		
28349 65	MILLION DOL	.1080	44.3	.0907	28.7	.1300	17.6		
28219 13	MILLION LBS	.1067			2.7	.1067	1.8		
28511 37	MILLION GAL	.1073	35.4	.2354	12.3	.0148	11.6	.0642	8.5
28995 93	MILLION GAL	.1074	24.3	.0666	17.6	.1606	9.7		
28517 41	MILLION GAL	.1058	8.1	.1058	4.9				
28199 11	THOUSAND TONS	.1041	8.4	.0371	7.0	.2068	3.3	.0946	2.1
28411 25	MILLION GAL	.1044	52.8	.1641	24.7	.0341	21.6		
28412 41	MILLION GAL	.1037			88.0	.1037	59.3		
28995 81	MILLION LBS	.1042	44.1	.0794	30.1	.0661	23.3	.1620	11.0
28344 79	MILLION DOL	.1029	81.1	.1643	37.9	.0306	33.6		
28423 94	MILLION DOL	.1034	113.7	.1551	55.3	.0420	46.9		
28445 --	THOUS UNITS	.1028	1645.5	.0949	1045.7	.1063	698.2	.1078	418.4
28332 21	MILLION DOL	.1021	29.5	.2203	10.9	-.0298	12.3		
28342 21	MILLION DOL	.1018	76.2	.1359	40.3	.0585	32.1		
28442 93	MILLION GAL	.1014	11.6	-.0423	14.4	.3230	4.7	.0939	3.0
28341 21	MILLION DOL	.1011	160.3	.1010	99.1	.0991	67.9		
28423 32	MILLION DOL	.0997	144.5	.3398	33.6	.0366	29.1	-.0530	38.2
28215 99	MILLION LBS	.0991			23.2	.0991	15.9		
28445 13	THOUS UNITS	.0987	74.7	.1159	43.2	.0697	33.0	.1053	20.0
28134 --	MILLION DOL	.0976	479.8				244.6	.1344	130.2
28199 94	THOUSAND TONS	.0977	5.1	.0977	3.2				
28213 93	MILLION LBS	.0982			1.6	.0982	1.1		
28345 99	MILLION DOL	.0978	22.0	.1289	12.0	.0601	9.5		

VALUE OF SHIPMENTS OF PRODUCTS

1972 PRODUCT CODE	UNIT OF MEASURE	TOTAL GROWTH RATE	1972 VALUE (MIL $)	GROWTH RATE	1967 VALUE (MIL $)	GROWTH RATE	1963 VALUE (MIL $)	GROWTH RATE	1958 VALUE (MIL $
28423 71	MILLION DOL	.0980	14.8	.0446	11.9	.0723	9.0	.1761	4.0
28443 21	MILLION GAL	.0976	84.0	.1495	41.8	-.0155	44.5	.1431	22.8
28515 52	MILLION GAL	.0979	29.2	.0366	24.4	.1331	14.5	.1338	7.9
28934 --	MILLION LBS	.0973	68.8	.1037	42.0	.1210	26.6	.0733	18.7
28211 61	MILLION DOL	.0971			81.3	.2008	39.1	.0207	35.3
28349 21	MILLION DOL	.0967	77.8	.1014	48.0	.1908	33.9		
28473 97	MILLION DOL	.0970	40.2	.0365	33.6	.1365	20.0	.1270	11.0
28516 44	MILLION GAL	.0969	60.0	.0755	41.7	.1243	26.1		
28518 21	MILLION GAL	.0967	22.2	.2526	7.2	-.0878	10.4	.1126	6.1
28521 71	MILLION DOL	.0969	16.8	.0149	15.6	.3037	5.4	.0326	4.6
28535 77	MILLION LBS	.0972	167.4	.0784	114.8	.1168	73.8	.1006	45.7
28349 69	MILLION DOL	.0964	8.7	.0951	5.5	.0965	3.8		
28171 --	THOUSAND TONS	.0952			827.3	.0863	594.0	.1023	365.0
28197 32	THOUSAND TONS	.0947	7.1	.1656	3.3	.0719	2.5	.0456	2.0
29741 --	MILLION DOL	.0956	598.3	.0695	420.2	.1285	259.1		
28346 21	MILLION DOL	.0945	42.6	.0939	27.2	.0953	18.9		
28912 --	MILLION LBS	.0948	148.1	.1143	86.2	.0971	59.5	.0737	41.7
28992 92	MILLION LBS	.0951	31.5	.0157	28.9	.1165	19.5	.1615	9.8
28134 2[illegible]	MIL CU FT	.0941	30.3	-.0497	39.1	.1106	25.7	.2448	8.6
28195 22	THOUSAND TONS	.0937	36.1	.0316	30.9	.0874	22.1	.1650	10.3
28342 85	MILLION DOL	.0937	39.2	.0447	31.5	.1583	17.5		
28197 13	THOUSAND TONS	.0927	4.5	.2298	1.6	.0339	1.4	.0149	1.3
28445 99	THOUS UNITS	.0933	52.3	.2294	18.7	-.0663	24.6	.1048	15.0
28349 31	MILLION DOL	.0917	71.6	.0640	52.5	.1274	32.5		
28345 43	MILLION DOL	.0923	37.2	.1068	22.4	.0746	16.8		
28935 67	MILLION LBS	.0923	96.1	.0923	61.8				
28196 61	THOUSAND TONS	.0906	63.6	.0955	38.4	.1235	24.1	.0601	18.0
28332 --	MILLION DOL	.0906	141.2	.1201	80.1	.0548	64.7		
28342 --	MILLION DOL	.0908	1651.8	.0775	1137.1	.1075	755.8		
28442 13	MILLION GAL	.0910	320.3	.1038	195.5	.1143	126.9	.0603	94.6
28445 93	THOUS UNITS	.0906	65.0	.0019	64.4	.2839	23.7	.0419	19.3
28349 47	MILLION DOL	.0906	18.9	.1335	10.1	.0380	8.7		
28443 --	MILLION GAL	.0907	1059.8	.0655	771.6	.0682	592.7	.1342	315.9
28653 11	MILLION DOL	.0898	249.3	.0898	162.2				
28917 79	MILLION LBS	.0899	30.6	.0899	19.9				
28349 --	MILLION DOL	.0891	234.0	.1156	135.4	.0524	110.4		
28249 43	MILLION DOL	.0892	4.1	-.0389	5.0	.2737	1.9		
28424 61	MILLION LBS	.0899	11.2	.0054	10.9	.1975	5.3	.0928	3.4
28441 37	MILLION LBS	.0892	74.1	.0262	65.1	.1580	36.2	.1008	22.4
28445 15	THOUS UNITS	.0899	41.5	.1470	20.9	.0957	14.5	.0285	12.6
28742 51	THOUSAND TONS	.0893	233.4	-.0307	272.8	.2604	108.1		
28345 61	MILLION DOL	.0884	44.8	.0524	34.7	.1351	21.9		
28441 --	MILLION DOL	.0880	243.8	.0640	178.8	.1263	111.1	.0820	74.9
28519 21	MILLION GAL	.0875	21.5	.0875	14.2				
28163 31	THOUSAND TONS	.0874	40.1	.0179	36.7	.1525	20.9	.1093	12.4
28139 43	THOUSAND TONS	.0866	41.6	.0693	29.9	.0336	26.2	.1505	13.0
28214 --	MILLION LBS	.0866	887.1	.1024	544.8	.0672	420.0		
28341 13	MILLION DOL	.0872	91.7	.1056	55.5	.0646	43.2		

VALUE OF SHIPMENTS OF PRODUCTS

1972 PRODUCT CODE	UNIT OF MEASURE	TOTAL GROWTH RATE	1972 VALUE (MIL $.)	GROWTH RATE	1967 VALUE (MIL $.)	GROWTH RATE	1963 VALUE (MIL $.)	GROWTH RATE	1958 VALUE (MIL $
28411 49	MILLION GAL	.0969	7.2	.0893	4.7	.0843	3.4		
28519 11	MILLION GAL	.0972	11.9	.0104	11.3	.0585	9.0	.1945	3.7
26831 11	MILLION DOL	.0968	459.7	.0795	315.1	.1197	200.5	.0695	143.3
28123 65	THOUSAND TONS	.0959	319.9	.1150	185.6	.0961	128.6	.0497	100.9
28213 89	MILLION LBS	.0955			242.3	.0855	174.5		
28411 --	MILLION DOL	.0957	633.5	.0857	417.9				
28973 --	MILLION LBS	.0963	92.2	.1421	42.3	.0265	38.1	.0803	25.9
28132 99	THOUSAND TONS	.0949	59.8	.1009	37.0	.0891	26.4	.0669	19.1
28344 75	MILLION DOL	.0952	28.9	.1262	15.9	.0360	13.8		
28346 --	MILLION DOL	.0949	333.9	.0792	229.1	.0934	160.3		
28348 17	MILLION DOL	.0949	63.3	.0692	45.7	.1049	30.4		
28742 61	THOUSAND TONS	.0953	66.2	.0015	65.7	.1998	31.7		
28095 11	MILLION LBS	.0949	10.0	.0900	6.5	.2132	3.0	-.0128	3.2
28211 23	MILLION DOL	.0945			55.4	.1591	30.8	.0290	26.7
28345 23	MILLION DOL	.0943	25.9	.0379	21.5	.1452	12.5		
28411 19	MILLION LBS	.0939	23.9	.2120	9.1	-.0463	11.0	.0739	7.7
28213 21	MILLION LBS	.0935			557.1	.0623	437.4	.1007	270.7
28344 --	MILLION DOL	.0932	581.6	.0996	361.4	.0529	293.1		
28423 97	MILLION DOL	.0927	43.7	-.0923	70.8	.3457	21.4		
28516 51	MILLION GAL	.0926	11.6	.0826	7.8				
28612 57	THOUSAND TONS	.0929			30.1	.0050	29.5	.1495	14.7
28199 01	THOUSAND TONS	.0922	44.4	-.0175	48.5	.0707	36.9	.2021	14.7
28413 99	MILLION LBS	.0916	9.0	.0919	5.8	.2221	2.6	-.0292	3.0
28432 51	MILLION LBS	.0919			13.2	.0443	11.1	.1133	5.5
28516 45	MILLION GAL	.0916	102.6	.0916	69.3				
28512 94	MILLION LBS	.0915	19.3	.0129	18.3	.3107	6.2	-.0094	6.5
28742 --	THOUSAND TONS	.0919	462.0	-.0314	541.9	.1394	321.5	.1592	153.6
28734 15	MILLION LBS	.0917	31.1	.0817	21.0				
28913 55	MILLION LBS	.0916	15.6	.1807	6.8	-.0142	7.2	.0672	5.2
28742 93	THOUSAND TONS	.0918	177.4	.0789	121.3				
28199 17	THOUSAND TONS	.0861	61.8	.1443	31.5	.1203	20.0	-.0037	21.0
28342 77	MILLION DOL	.0861	18.8	.0476	14.9	.1221	9.4		
28343 11	MILLION DOL	.0861	17.4	.0754	12.1	.0860	8.7		
28349 31	MILLION DOL	.0801	1.9	.0945	1.2	.0746	0.9		
28519 --	MILLION GAL	.0795	342.5	.0777	235.6	.0550	190.2	.1015	117.3
28612 91	MILLION LBS	.0802	44.2	.1145	25.7	.0173	24.0	.0986	15.0
28693 31	MILLION DOL	.0792	34.9	.0458	27.9	.0373	24.1	.1497	12.0
28198 --	THOUSAND TONS	.0778	160.4	.0726	113.0	.1101	74.4	.0577	56.2
28199 03	THOUSAND TONS	.0784	2.4	.1144	1.4	.0393	1.2	.0845	0.8
28331 11	MILLION DOL	.0779	250.2	.0548	191.6	.1059	127.7		
28345 85	MILLION DOL	.0785	7.5	.1027	4.6	.0479	3.8		
28935 --	MILLION LBS	.0773	579.2	.0653	1136.1	.1042	770.3	.0671	557.2
28995 29	MILLION LBS	.0765	39.6	-.0992	66.4	.4164	16.5	.0319	14.1
28211 65	MILLION DOL	.0762			113.1	.1108	74.3	.0493	59.4
28313 11	MILLION DOL	.0756	18.3	.0758	12.7				
28344 83	MILLION DOL	.0758	71.0	.1714	38.3	.0100	36.9		
28745 --	MILLION DOL	.0755	778.3	.0711	552.1	.0826	402.9		
28133 17	THOUSAND TONS	.0742	10.7	.0206	9.5	.0375	8.2	.1046	5.1

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VALUE OF SHIPMENTS OF PRODUCTS

1972 PRODUCT CODE	UNIT OF MEASURE	TOTAL GROWTH RATE	1972 VALUE (MIL $)	GROWTH RATE	1967 VALUE (MIL $)	GROWTH RATE	1963 VALUE (MIL $)	GROWTH RATE	1958 VALUE (MIL $)
28349 71	MILLION DOL	.0746	412.5	.0853	273.9	.0614	215.8		
28519 77	MILLION GAL	.0750	167.8	.0465	133.7	.0674	103.0	.1105	61.0
28134 51	MIL CU FT	.0738	216.9	.0175	208.9	.1123	136.4	.1126	80.0
28344 41	MILLION DOL	.0742	272.2	.1193	155.6	.0215	142.9		
28346 13	MILLION DOL	.0741	33.3	.0835	22.3	.0625	17.5		
28511 32	MILLION GAL	.0735	38.6	.1768	17.1	-.0384	20.3	.0694	14.3
28514 49	MILLION GAL	.0745	10.5	.0383	8.7	.1215	5.5		
28995 39	MILLION LBS	.0742	209.1	.0965	131.9	-.0251	146.0	.1371	76.8
28163 27	THOUSAND TONS	.0729	14.2	.1961	5.8	-.0125	6.1	.0285	5.3
28341 35	MILLION DOL	.0731	16.6	.0347	14.0	.1231	8.8		
28445 41	THOUS UNITS	.0728	119.9	.0682	86.2	.0694	65.9	.0802	44.8
28515 13	MILLION GAL	.0730	67.6	.0763	46.8	.1148	30.3	.0375	25.2
28612 --	MILLION LBS	.0733	192.6	.1153	111.6	.0004	111.4	.0927	71.5
28651 11	MILLION DOL	.0729	1515.3	.0729	1066.1				
28921 61	MILLION DOL	.0726	21.6	-.0655	30.3	.0482	25.1	.2539	8.1
28211 63	MILLION DOL	.0716			85.7	.1203	54.4	.0341	46.0
28745 35	MILLION DOL	.0715	33.7	.0676	24.3	.0764	18.1		
28348 23	MILLION DOL	.0716	47.5	-.0172	51.8	.1938	25.5		
28411 26	MILLION LBS	.0707	110.4	.1374	58.0	-.0072	59.7		
28652 11	MILLION DOL	.0726	457.9	.0706	325.6				
28693 51	MILLION DOL	.0714	363.0	.0326	309.2	.1152	199.9	.0765	138.3
28102 --	THOUSAND TONS	.0599			209.4	.0114	200.1	.1191	114.0
28343 41	MILLION DOL	.0705	69.4	.0627	51.2	.0802	37.6		
28340 99	MILLION DOL	.0701	4.6	.0687	3.3	.0719	2.5		
28242 31	MILLION LBS	.0693	331.9	.0294	287.2	.1214	181.6		
28348 71	MILLION DOL	.0687	23.1	.0749	16.1	.0611	12.7		
28514 --	MILLION GAL	.0694	429.4	.0803	291.9	.0388	250.7	.0836	167.8
28519 93	MILLION GAL	.0595	18.3	.1285	10.0	0.0000	10.0		
28612 13	MILLION DOL	.0692	5424.0	.0600	4052.2	.0668	3129.1	.0803	2126.6
28794 --	MILLION LBS	.0595	151.9	.0316	130.0				
28197 51	THOUSAND TONS	.0692	6.3	-.0152	6.8	.1419	4.0	.0986	2.5
28212 51	MILLION LBS	.0583			102.2	.0706	77.8	.0664	56.4
28347 95	MILLION DOL	.0677	44.9	.0748	31.3	.0589	24.9		
28348 --	MILLION DOL	.0685	944.1	.0729	664.5	.0632	520.1		
28432 95	MILLION LBS	.0680	352.9	.0579	266.3	.0899	188.7	.0609	140.5
28445 13	THOUS UNITS	.0677	92.1	.0961	58.2	.0133	55.2	.0845	36.8
28445 21	THOUS UNITS	.0676	111.0	.0371	92.5	.0897	65.6	.0812	44.4
28513 71	MILLION GAL	.0635	13.9	.0884	9.1	.0172	8.5	.0910	5.5
28743 99	MILLION LBS	.0680	10.3	.1217	5.8	-.2776	21.3	.3903	4.1
28134 15	MIL CU FT	.0667	33.1	.0536	25.5	.0895	18.1	.0620	13.4
28199 93	THOUSAND TONS	.0670	107.6	.1277	59.0	-.0042	60.0		
28345 15	MILLION DOL	.0671	181.4	.0573	137.3	.0795	101.1		
28346 35	MILLION DOL	.0665	20.0	.0900	13.0	.0380	11.2		
28423 85	MILLION DOL	.0674	36.9	.2397	12.6	-.0694	16.8	.0257	14.8
28995 15	MILLION LBS	.0672	15.8	.0038	15.5	.1520	8.8		
28935 10	MILLION LBS	.0659	21.3	.0309	18.3	.1136	11.9		
28199 16	THOUSAND TONS	.0661	4.9	.0578	3.7	.0538	3.0	.0845	2.0
28341 99	MILLION DOL	.0555	17.0	.1165	9.8	.0052	9.6		

VALUE OF SHIPMENTS OF PRODUCTS

1972 PRODUCT CODE	UNIT OF MEASURE	TOTAL GROWTH RATE	1972 VALUE (MIL $)	GROWTH RATE	1967 VALUE (MIL $)	GROWTH RATE	1963 VALUE (MIL $)	GROWTH RATE	1959 VALUE (MIL $)
28347 15	MILLION DOL	.0664	39.4	.0932	25.0	.0313	22.1		
28347 31	MILLION DOL	.0660	9.6	.0986	6.0	.0267	5.4		
28424 23	MILLION GAL	.0660	20.3	.0711	14.4	-.0166	15.4	.1316	8.3
28444 --	MILLION GAL	.0661	484.5	.0844	323.1	.0906	228.4	.0292	197.8
28693 --	MILLION DOL	.0664	717.1	.0413	585.6	.0823	426.8	.0793	291.4
28517 11	MILLION GAL	.0645	57.1	.0722	40.3	.0473	33.5	.0708	23.8
28733 67	MILLION LBS	.0654	6.8	.0154	6.3	.1940	3.1	.0206	2.8
28315 13	MILLION DOL	.0645	46.6	.0645	34.1				
28635 93	MILLION DOL	.0639	69.3	.0044	67.8	.0807	49.7	.1130	29.1
28935 43	MILLION LBS	.0636	42.7	.0222	38.3	.1193	24.4	.0627	18.0
28217 11	MILLION LBS	.0633			236.0	.0633	184.6		
28411 47	MILLION GAL	.0632	62.2	.1238	34.7	-.0085	35.9		
28433 --	MILLION LBS	.0625	505.8	.0625	373.5				
28516 39	MILLION GAL	.0621	60.3	.0449	48.4	.1098	31.9	.0450	25.6
28693 31	MILLION DOL	.0632	230.6	.0865	152.3	.0250	138.0	.0713	97.8
28995 95	MILLION GAL	.0631	414.4	.0653	302.1	.0799	222.1	.0476	176.0
28123 --	MILLION DOL	.0618	410.5	.1000	254.9	.0500	209.7	.0341	177.3
28139 12	THOUSAND TONS	.0620	7.2	.0271	6.3	.0542	5.1	.1047	3.1
28241 --	MILLION LBS	.0622	1543.1	.0763	1068.4	.0449	896.1		
28315 --	MILLION DOL	.0624	82.8	.1157	47.9	.0416	40.7	.0277	35.5
28331 --	MILLION DOL	.0616	629.7	.0457	503.7	.0818	367.8		
28197 16	THOUSAND TONS	.0616	16.4	.1487	8.2	-.0118	8.6	.0362	7.2
28197 61	THOUSAND TONS	.0612	17.0	.0253	15.0	.0933	10.5	.0725	7.4
28345 27	MILLION DOL	.0607	5.1	.0551	3.9	.0673	3.0		
28346 37	MILLION DOL	.0609	12.6	.0494	9.9	.0755	7.4		
28516 11	MILLION GAL	.0610	57.3	.0601	42.8	.1382	25.5	.0040	25.0
28163 --	THOUSAND TONS	.0604	284.5	.0849	189.3	.0567	151.8	.0394	125.1
28136 71	MILLION DOL	.0598	27.3	.0114	25.8	.0671	19.9	.1046	12.1
28345 71	MILLION DOL	.0596	80.8	.0723	57.0	.0439	48.0		
28345 63	MILLION DOL	.0602	19.8	.1187	11.3	-.0087	11.7		
28349 37	MILLION DOL	.0604	3.9	.1114	2.3	0.0000	2.3		
28423 91	MILLION DOL	.0599	144.3	.0411	118.0	.1083	78.2	.0409	64.0
28517 99	MILLION GAL	.0598	40.1	.0598	30.0				
28162 21	THOUSAND TONS	.0594	79.2	.1105	46.9	.0853	33.8	-.0086	35.3
28136 --	THOUSAND TONS	.0592	174.2	.0649	127.2	.0521	103.8		
28199 57	THOUSAND TONS	.0588	6.9	.1209	3.9	.0678	3.0	-.0065	3.1
28199 71	THOUSAND AV 72	.0587	2.0	-.0779	3.0	.1362	1.8	.1487	0.9
28441 59	THOUS UNITS	.0586	9.1	.0236	8.1	-.0778	11.2	.2226	4.1
28515 --	MILLION GAL	.0589	73.3	.1095	43.6	-.0011	43.8		
28611 31	MILLION LBS	.0592	43.6	-.0018	44.0	.0987	30.2	.0914	19.5
28695 --	MILLION DOL	.0576	265.8	.0211	239.4	.0563	192.3	.0964	121.4
28931 15	MILLION LBS	.0581	44.1	.0313	37.8	.1238	23.7	.0345	20.0
28933 43	MILLION LBS	.0580	36.1	.1346	19.2	-.0657	25.2	.0897	16.4
28199 37	MILLION DOL	.0571	23.5	.0151	21.8	.1231	13.7	.0487	10.8
28199 74	THOUSAND TONS	.0570	29.8	-.0619	41.0	.2268	18.1		
28213 51	MILLION LBS	.0566			234.9	.0566	188.5		
28342 79	MILLION DOL	.0574	3.8	.0350	3.2	.0861	2.3		
28344 33	MILLION DOL	.0575	11.2	.0543	8.6	.0605	6.8		

VALUE OF SHIPMENTS OF PRODUCTS

1972 PRODUCT CODE	UNIT OF MEASURE	TOTAL GROWTH RATE	1972 VALUE (MIL $)	GROWTH RATE	1967 VALUE (MIL $)	GROWTH RATE	1963 VALUE (MIL $)	GROWTH RATE	1958 VALUE (MIL $
28345 24	MILLION DOL	.0569	15.3	.0219	13.8	.1037	9.3		
28444 93	THOUS UNITS	.0568	1.7	-.2013	4.0	.4520	0.9	.0845	0.5
28197 21	THOUSAND TONS	.0562	37.2	.0385	30.8	.0644	24.0	.0677	17.3
28199 --	THOUSAND TONS	.0561	1305.5	.0393	1076.9	.0663	833.0	.0650	607.9
28199 56	THOUSAND TONS	.0564	6.9	-.0085	7.2	.1375	4.3	.0609	3.2
28932 --	MILLION TONS	.0562	145.3	.0551	111.1	.0597	88.1	.0544	67.6
28992 11	MILLION LBS	.0557	17.3	.0777	11.9	.0607	9.4	.1302	5.1
28199 24	THOUSAND TONS	.0553	29.3	.0479	23.2	.0404	19.8	.0749	13.8
28447 99	MILLION GAL	.0546	16.2	.0795	11.1	-.0131	11.7	.0873	7.7
28516 --	MILLION GAL	.0555	929.0	.0527	718.5	.0355	624.9	.0744	436.4
28697 11	MILLION DOL	.0552	117.4	-.0027	119.0	.0824	86.7	.0941	55.3
28153 91	THOUSAND TONS	.0543	36.5	.1290	19.9	-.0619	25.7	.0811	17.4
28194 31	THOUSAND TONS	.0537	15.8	.0593	11.9	.0524	9.7	.0500	7.5
28232 41	MILLION LBS	.0539	210.2	.0580	158.6	.0008	158.1	.0942	100.8
28411 79	MILLION LBS	.0533	10.3	.0772	7.1	.1271	4.4	-.0252	5.0
28518 --	MILLION GAL	.0532	134.3	.0642	98.4	-.0642	128.3	.1450	65.2
28695 39	MILLION DOL	.0531	6.4	.2341	2.2	.1196	1.4	-.1470	3.1
28139	THOUSAND TONS	.0517	8.3	.0469	6.6	.1284	5.9	.0755	4.1
28731 2	MILLION DOL	.0521	379.5	.0399	312.1	.0677	240.2		
28516 31	MILLION GAL	.0518	127.3	.0129	119.4	.0506	98.0	.0931	62.8
28124 22	THOUSAND TONS	.0508	21.4	.0399	17.6	.0646	13.7		
28197 3	THOUSAND TONS	.0511	20.9	.0459	16.7	.0626	13.1	.0472	10.4
28347 13	MILLION DOL	.0512	31.5	.0764	21.8	.0205	20.1		
28342 23	MILLION DOL	.0514	229.6	.0622	170.5	.0631	133.5		
28932 39	MILLION LBS	.0512	40.6	.1234	23.0	-.0293	25.9		
28992 23	MILLION LBS	.0512	40.9	.1125	24.0	-.0208	26.1		
28344 61	MILLION DOL	.0502	65.6	.0807	44.5	.0134	42.2		
28731 53	THOUSAND TONS	.0497	29.7	.0497	23.3				
28199 61	THOUSAND TONS	.0488	10.9	.1231	6.1	-.0372	7.1		
28214 11	MILLION LBS	.0490			126.0	.0537	102.2	.0453	81.9
28345 19	MILLION DOL	.0494	42.6	.0062	41.3	.1060	27.6		
28411 41	MILLION LBS	.0489	42.1	.0180	38.5	.0887	27.4		
28517 21	MILLION GAL	.0491	78.3	.0491	61.6				
28124 --	MILLION DOL	.0479	33.7	-.0097	35.2	.0627	27.6	.0954	17.5
28197 27	THOUSAND TONS	.0477	16.7	-.0093	17.5	.0118	16.7	.1393	8.7
28199 42	THOUSAND TONS	.0481	5.6	.0447	4.5	.0056	4.4	.0870	2.9
28349 11	MILLION DOL	.0475	12.0	.0157	11.1	.0837	7.9		
28935 61	MILLION LBS	.0476	50.4	.0294	43.6	.0890	31.0	.0334	26.3
28514 11	MILLION GAL	.0473	310.5	.0473	246.4				
28162 --	THOUSAND TONS	.0456	101.6	.0921	65.4	.0673	50.4	-.0152	54.4
28196 55	THOUSAND TONS	.0459	3.0	.0640	2.2	-.0111	2.3	.0753	1.6
28241 13	MILLION LBS	.0455	1236.1	.0455	994.7				
28341 11	MILLION DOL	.0458	94.1	.0473	74.7	.0439	62.9		
28349 35	MILLION DOL	.0461	6.0	.0413	4.9	.0520	4.0		
28417 31	MILLION GAL	.0459	299.0	.0459	238.9				
28444 11	MILLION LBS	.0462	294.8	.0467	234.6	.0756	175.3	.0227	156.7
28413 11	MILLION LBS	.0449	327.4	.0527	253.3	.0400	216.5	.0411	177.0
28445 43	MILLION LBS	.0457	41.1	-.0117	43.6	.0779	32.3	.0789	22.1

VALUE OF SHIPMENTS OF PRODUCTS

1972 PRODUCT CODE	UNIT OF MEASURE	TOTAL GROWTH RATE	1972 VALUE (MIL $)	GROWTH RATE	1967 VALUE (MIL $)	GROWTH RATE	1963 VALUE (MIL $)	GROWTH RATE	1958 VALUE (MIL $
28914 48	MILLION LBS	.0449	87.7	.0449	70.4				
28932 35	MILLION LBS	.0455	27.9	.0496	21.9	.0403	18.7		
28995 72	MILLION GAL	.0453	17.3	.1322	9.3	-.0228	10.2	.0186	9.3
28121 15	THOUSAND TONS	.0442	182.5	.0180	166.9	.0416	141.9	.0732	99.6
28216 --	MILLION LBS	.0437			286.6	.0130	272.2	.0690	195.0
28349 25	MILLION DOL	.0444	6.8	.0861	4.5	-.0055	4.6		
28422 --	MILLION DOL	.0440	210.2	.0443	169.5				
28422 43	MILLION DOL	.0443	188.3	.0443	151.6				
28194 47	THOUSAND TONS	.0434	29.0	.0667	21.0	.0824	15.3	-.0089	16.0
28195 --	THOUSAND TONS	.0432	397.9	-.0118	429.5	.0648	318.5	.0822	214.6
28197 41	THOUSAND TONS	.0434	45.3	.0866	29.9	.0121	28.5	.0266	25.0
28752 51	THOUSAND TONS	.0432	12.0	.0640	8.9	.0178	8.2		
28035 45	MILLION LBS	.0434	17.4	-.0518	22.7	.1167	14.6	.0875	9.6
28213 67	MILLION LBS	.0419			26.5	.0418	22.5		
28345 49	MILLION DOL	.0415	7.5	.0422	6.1	.0407	5.2		
28412 --	MILLION DOL	.0415	1629.6	.0415	1329.7				
28510 99	MILLION GAL	.0420	222.6	-.0606	304.2	.2922	109.1	-.0272	125.2
28511 21	MILLION GAL	.0422	12.3	.0575	9.3	-.0299	10.5	.0976	6.9
28511 30	MILLION GAL	.0418	20.4	.1356	10.8	.0119	10.3	-.0218	11.3
28518 63	MILLION GAL	.0416	26.9	.0030	26.5	.0251	24.0	.0957	15.2
28913 51	MILLION LBS	.0418	28.4	.0674	20.5	.0152	19.3	.0382	16.0
28121 --	MILLION DOL	.0414	207.2	.0192	188.6	.0341	164.9	.0703	117.4
28344 21	MILLION DOL	.0412	32.5	.0347	27.4	.0493	22.6		
28153 41	THOUSAND TONS	.0401	11.1	.0452	8.9	.0946	6.2	-.0063	6.4
28197 84	THOUSAND TONS	.0404	9.4	-.0428	11.7	.0864	8.4	.0924	5.4
28197 87	MILLION DOL	.0397	141.3	.0680	101.7	.0254	92.0	.0235	81.9
28199 75	THOUSAND TONS	.0404	5.4	-.0142	5.8	.0973	4.0	.0523	3.1
28347 57	MILLION DOL	.0404	4.9	.0592	3.0	.0174	2.9		
28347 99	MILLION DOL	.0404	4.0	.1270	2.2	-.0585	2.9		
28412 24	MILLION LBS	.0400	851.5	.0338	719.7	.0403	605.2		
28995 87	MILLION LBS	.0395	45.6	.0734	32.0	-.0304	36.2	.0644	26.5
28199 14	THOUSAND TONS	.0399	26.1	.0505	20.4	-.0084	21.1	.0664	15.3
28343 31	MILLION DOL	.0398	7.9	.0132	7.4	.0722	5.6		
28995 99	MILLION GAL	.0389	71.7	.0631	52.8	.1739	27.9	-.0792	42.0
28196 51	THOUSAND TONS	.0383	51.6	.0362	43.2	.0555	34.8	.0267	30.5
28342 55	MILLION DOL	.0384	121.7	.0096	115.0	.0755	86.7		
28346 15	MILLION DOL	.0384	7.3	.0366	6.1	.0407	5.2		
28443 39	MILLION GAL	.0391	28.7	.0086	27.5	.0562	22.1	.0539	17.0
28122 31	THOUSAND TONS	.0367	10.6	.0745	7.4	.0176	6.9	.0152	6.4
28197 35	THOUSAND TONS	.0373	16.7	.0344	14.1	.0593	11.2	.0229	10.0
28199 13	THOUSAND TONS	.0368	12.1	.0289	10.5	.0806	7.7	.0107	7.3
28199 68	THOUSAND TONS	.0366	64.4	.0366	53.8				
28742 71	THOUSAND TONS	.0373	25.3	.3206	6.3	-.2330	18.2		
28794 35	MILLION LBS	.0371	13.2	.0371	11.0				
28167 45	THOUSAND TONS	.0356	49.3	.1039	30.5	.0348	26.6	-.0251	30.2
28199 52	THOUSAND TONS	.0359	13.1	.0641	9.6	.0941	6.7	-.0348	8.0
28231 21	MILLION LBS	.0358	150.5	.0193	136.8	.0567	109.7		
28424 --	MILLION DOL	.0362	395.3	.0403	324.5	.0397	278.4	.0302	240.3

VALUE OF SHIPMENTS OF PRODUCTS

1972 PRODUCT CODE	UNIT OF MEASURE	TOTAL GROWTH RATE	1972 VALUE (MIL $)	GROWTH RATE	1967 VALUE (MIL $)	GROWTH RATE	1963 VALUE (MIL $)	GROWTH RATE	1958 VALUE (MIL $
28424 25	MILLION LBS	.0369	10.5	-.0193	11.0	.0141	10.4	.1020	6.4
28511 11	MILLION GAL	.0358	26.5	.0159	24.5	.2845	9.0	-.1109	16.2
28794 12	MILLION LBS	.0361	28.3	.0361	23.7				
28913 41	MILLION LBS	.0360	8.2	.0075	7.9	.0235	7.2	.0757	5.0
28992 61	MILLION LBS	.0369	14.6	.0251	12.9	.0269	11.5	.0544	8.9
28153 51	THOUSAND TONS	.0353	6.5	.0231	5.8	.0431	4.9	.0414	4.0
28424 44	MILLION LBS	.0345	18.5	.0334	15.7	.0347	13.7	.0356	11.5
28445 11	THOUS UNITS	.0349	39.1	-.0703	56.2	.2422	23.6	-.0050	24.2
28513 53	MILLION GAL	.0347	61.8	.0347	52.1				
28516 13	MILLION GAL	.0354	42.5	.0384	35.2	.0685	27.0	.0068	26.1
28122 41	THOUSAND TONS	.1342	82.0	.0188	74.7	.0378	64.4	.0469	51.2
28134 99	MILLION DOL	.0344	28.9	.0230	25.8	.0528	21.0	.0313	18.0
28197 37	THOUSAND TONS	.0339	6.7	.0690	4.8	.3466	4.0	-.0097	4.2
28219 41	MILLION LBS	.0339			20.5	.0288	19.3	.0378	15.2
28512 93	MILLION GAL	.0344	6.1	.0209	5.5	.0514	4.5		
28514 93	MILLION GAL	.0339	19.9	.1259	11.0	-.0880	15.9	.0493	12.5
28147 21	THOUSAND TONS	.0328	2.2	.0410	1.8	.0648	1.4	0.0000	1.4
28199 53	THOUSAND TONS	.0327	195.1	.0117	184.1	.0597	146.3		
28913 25	MILLION LBS	.0332	14.7	.0935	9.4	-.1011	14.4	.0914	9.3
28915 53	MILLION LBS	.0329	68.6	.0514	53.4	.0569	42.8	-.0037	43.6
28197 34	THOUSAND TONS	.0322	143.6	.0239	127.6	.0421	108.2	.0325	92.2
28344 99	MILLION DOL	.0319	12.2	-.0032	12.4	.0775	9.2		
28411 43	MILLION LBS	.0316	13.1	-.0765	19.5	.1847	9.9		
28411 42	MILLION GAL	.0322	43.9	.0261	38.6	.0400	33.1		
28791 13	MILLION LBS	.0318	3.1	-.0399	3.8	.0136	3.6	.1247	2.0
28991 11	MILLION TONS	.0317	133.9	.0371	111.6	.0320	98.4	.0261	86.5
28161 11	THOUSAND TONS	.0317	355.5	.0364	297.3	.0176	277.3	.0353	232.0
28193 31	THOUSAND TONS	.0315	285.5	.0418	233.8	.0667	157.4	.0312	135.0
28197 --	THOUSAND TONS	.0309	653.0	.0294	565.0	.0222	517.5	.0393	426.7
28413 61	MILLION LBS	.0309	9.2	.0209	8.3	.0435	7.0		
28423 21	MILLION DOL	.0315	19.5	.0315	16.7				
28199 87	THOUSAND TONS	.0299	6.8	.0359	5.7	.0609	4.5	0.0000	4.5
28424 11	MILLION DOL	.0299	39.3	.0312	33.7	.0374	29.1	.0229	26.0
28424 99	MILLION DOL	.0297	27.4	.0439	22.1	.2698	8.5	-.1412	18.2
28612 11	THOU[illegible]GAL	.0303	4.1	.2229	1.5	-.0694	2.0	-.0583	2.7
28915 71	MILLION LBS	[illegible]	18.3	.0133	18.0	.0159	16.9	.0691	12.1
28153 14	THOUSAND TONS	.0288	4.6	.0136	4.3	.0767	3.2	.0064	3.1
28193 11	THOUSAND TONS	.0292	31.4	.0132	29.4	.0322	25.9	.0428	21.0
28342 81	MILLION DOL	.0293	19.2	.0394	15.9	.0181	14.9		
28219 --	MILLION LBS	.0282			57.5	.0282	60.4		
28242 71	MILLION LBS	.0282	59.3	.0282	51.6				
28349 13	MILLION DOL	.0279	6.4	.0234	5.7	.0333	5.0		
28519 11	MILLION GAL	.0285	70.1	.0330	59.6	.0245	54.1	.0272	47.3
28193 --	THOUSAND TONS	.0274	249.1	-.0033	252.2	.0651	196.0	.0289	170.0
28197 43	MILLION DOL	.0268	21.3	.0189	19.4	.0477	16.1	.0184	14.7
28342 23	MILLION DOL	.0265	90.6	[illegible]	97.2	.0524	71.1		
28344 11	MILLION DOL	.0273	42.7	.0549	32.7	-.0560	33.5		
28344 35	MILLION DOL	.0272	16.3	-.0175	17.8	.0859	12.9		

VALUE OF SHIPMENTS OF PRODUCTS

1972 PRODUCT CODE	UNIT OF MEASURE	TOTAL GROWTH RATE	1972 VALUE (MIL $)	GROWTH RATE	1967 VALUE (MIL $)	GROWTH RATE	1963 VALUE (MIL $)	GROWTH RATE	1958 VALUE (MIL $
28345 11	MILLION DOL	.0268	13.7	.0029	13.5	.0574	10.8		
28512 19	MILLION GAL	.0273	13.0	.0248	11.5	.0304	10.2		
28139 32	THOUSAND TONS	.0262	8.9	-.0362	10.7	.1119	7.0	.0246	6.2
28345 37	MILLION DOL	.0265	6.2	-.0032	6.3	.0649	4.9		
28345 45	MILLION DOL	.0263	16.8	.0229	15.0	.0305	13.3		
28516 47	MILLION GAL	.0262	46.7	.0325	39.8	.0184	37.0		
28731 52	THOUSAND TONS	.0257	158.4	.0257	139.5				
28921 43	MILLION UNITS	.0263	16.1	-.0274	18.5	.0610	14.6	.0545	11.2
28346 31	MILLION DOL	.0249	28.7	.1479	14.4	-.1105	23.0		
28411 14	MILLION GAL	.0252	21.0	.0407	17.2	.0297	15.3	.0067	14.8
28413 --	MILLION DOL	.0249	406.6	.0414	332.0	.0288	296.3	.0053	289.5
28517 --	MILLION GAL	.0245	235.2	.0534	181.3	-.0044	184.2	.0192	167.5
28731 51	THOUSAND TONS	.0247	12.2	.0247	10.8				
28931 13	MILLION LBS	.0253	14.9	.0765	10.3	.0074	10.0	-.0097	10.5
28932 87	MILLION LBS	.0246	16.7	-.0430	20.8	.1572	11.6	-.0051	11.9
28121 11	THOUSAND TONS	.0237	24.7	.0262	21.7	-.0155	23.1	.0535	17.8
28133 11	THOUSAND TONS	.0244	23.4	-.0446	29.4	.0141	27.8	.1073	16.7
28231 --	MILLION LBS	.0244	295.3	-.0276	339.7	.0793	250.3	.0350	210.7
28424 21	MILLION GAL	.0245	125.2	.0124	117.0	.0197	104.5	.0405	85.7
28742 41	THOUSAND TONS	.0236	111.9	-.0562	149.4	.0914	105.3	.0547	80.7
28122 67	THOUSAND TONS	.0233	50.5	.0375	42.0	.0018	41.7	.0264	36.6
28199 39	THOUSAND TONS	.0232	31.0	.0148	28.8	.0230	26.3	.0317	22.5
28199 92	THOUSAND TONS	.0229	15.9	.0229	14.2				
28214 21	MILLION LBS	.0231			131.2	-.0300	149.2	.0677	106.9
28516 27	MILLION GAL	.0232	12.9	.0232	11.5				
28752 --	THOUSAND TONS	.0230	684.4	.0054	539.2	.0453	492.7		
28199 61	THOUSAND TONS	.0219	4.2	-.0047	4.3	.0182	4.0	.0523	3.1
28424 63	MILLION LBS	.0224	19.1	.0224	17.1	.0316	15.1	.0152	14.0
28163 13	THOUSAND TONS	.0212	5.9	.0256	5.2	.0311	4.6	.0089	4.4
28199 83	MILLION DOL	.0211			12.2	.0134	11.9	.0296	10.2
28232 51	MILLION LBS	.0200	12.4	.0570	9.4	-.0250	10.4	.0204	9.4
28791 --	MILLION LBS	.0204	385.0	.0204	348.0				
28122 --	MILLION DOL	.0188	147.0	.0085	140.9	.0333	123.6	.0176	113.3
28345 21	MILLION DOL	.0192	33.0	.0206	29.8	.0175	27.3		
28517 53	MILLION GAL	.0191	25.4	.0725	17.9	.1085	9.6	-.1321	19.5
28994 31	MILLION LBS	.0191	16.6	.0191	15.1				
28199 23	THOUSAND TONS	.0183	24.5	.0127	23.0	.0206	21.2	.0222	19.0
28345 87	MILLION DOL	.0184	9.9	-.0409	12.2	.0978	8.4		
28749 99	MILLION DOL	.0177	21.9	.0056	21.3	.0331	18.7		
28231 11	MILLION LBS	.0169	69.1	-.1021	118.4	.1882	59.4		
28695 11	MILLION DOL	.0168	74.9	-.0074	77.8	.0129	73.9	.0454	59.2
28731 59	THOUSAND TONS	.0173	227.5	.0173	209.1				
28197 33	THOUSAND TONS	.0165	4.4	.0468	3.5	-.0328	4.3	.0271	3.5
28197 34	THOUSAND TONS	.0161	10.5	.0336	8.9	-.0211	10.1	.0375	8.4
28216 21	MILLION LBS	.0155			159.1	.0155	149.6		
28194 11	THOUSAND TONS	.0151	11.1	.0211	10.0	-.0074	10.3	.0274	9.0
28136 17	THOUSAND TONS	.0153	8.9	-.0130	9.5	.1217	6.0	-.0358	7.2
28199 16	THOUSAND TONS	.0153	8.3	-.1432	11.1	.0239	10.1	.0760	7.2

VALUE OF SHIPMENTS OF PRODUCTS

1972 PRODUCT CODE	UNIT OF MEASURE	TOTAL GROWTH RATE	1972 VALUE (MIL $.)	GROWTH RATE	1967 VALUE (MIL $)	GROWTH RATE	1963 VALUE (MIL $.)	GROWTH RATE	1958 VALUE (MIL $
28412 53	MILLION LBS	.0147			58.4	.0004	58.3	.0263	60.0
28511 --	MILLION GAL	.0145	460.6	.0692	329.7	-.0437	394.2	.0100	375.0
28219 19	MILLION LBS	.0131			23.6	.0131	22.4		
28344 59	MILLION DOL	.0129	9.2	.0753	6.4	-.0601	8.2		
28345 59	MILLION DOL	.0132	3.6	-.0304	4.2	.0703	3.2		
28411 --	MILLION LBS	.0119	94.1	.0294	81.4	-.0030	82.4	.0067	79.7
28752 13	THOUSAND TONS	.0117	393.7	.0009	392.0	.0254	354.6		
28793 69	MILLION LBS	.0121	34.1	.0141	31.8	.0609	25.1	-.0271	28.8
28343 21	MILLION DOL	.0114	7.2	.0207	6.5	0.0000	6.5		
28516 33	MILLION GAL	.0112	11.1	.0112	10.5				
28611 23	MILLION LBS	.0113	11.7	.0278	10.2	.0497	8.4	-.0343	10.0
28513 --	MILLION GAL	.0096	321.7	.0370	268.2	-.0199	290.6	.0063	281.6
28741 81	THOUSAND TONS	.0105	45.3	.0105	43.0				
28212 --	MILLION LBS	.0099			326.9	-.0005	327.6	.0164	302.0
28412 21	MILLION LBS	.0098	62.7	-.0454	79.1	.0825	57.6		
28152 13	THOUSAND TONS	.0076	5.0	-.4023	65.4	1.0108	4.0	-.0233	4.5
28197 29	THOUSAND TONS	.0094	2.7	-.0611	3.7	.0820	2.7	.0239	2.4
28199 81	THOUSAND TONS	.0077			1.5	-.0160	1.6	.0271	1.4
28348 31	MILLION DOL	.0081	5.7	.0630	4.2	-.0565	5.3		
28347 14	MILLION DOL	.0073	14.9	.0665	10.8	-.0611	13.9		
28517 54	MILLION GAL	.0078	60.4	.0078	58.1				
28971 --	MILLION LBS	.0075	108.3	.0163	99.9	.0181	93.0	-.0108	98.2
28345 91	MILLION DOL	.0062	3.7	.0499	2.9	-.0459	3.5		
28517 31	MILLION GAL	.0062	32.5	.0262	31.8				
28992 53	MILLION LBS	.0057	14.7	.0763	9.9	-.0238	10.9	-.0376	13.2
28215 11	MILLION LBS	.0051			125.2	.0051	122.7		
28511 25	MILLION GAL	.0055	30.0	.0259	26.4	-.0834	37.4	.0611	27.8
28743 97	THOUSAND TONS	.0050	16.1	.3994	3.0	-.3356	15.4		
28199 53	THOUSAND TONS	.0036	3.1	.0525	2.4	-.0543	3.0		
28349 55	MILLION DOL	.0030	17.6	-.0193	19.4	.0266	17.1		
28232 --	MILLION LBS	.0029	387.8	.0264	340.5	-.0386	398.6	.0137	372.3
28921 --	MILLION DOL	.0026	232.9	.0026	229.8				
28511 75	MILLION GAL	.0022	16.2	.0709	11.5	-.0147	12.2	-.0492	15.7
28513 63	MILLION GAL	.0021	29.3	.0517	22.0	-.0784	30.5	.0209	27.5
28792 84	MILLION LBS	.0018	8.1	-.1999	24.7	.1809	12.7	.0996	7.9
28197 17	THOUSAND TONS	.0016	90.1	-.0151	97.2	-.0260	108.0	.0385	89.4
28231 17	MILLION LBS	.0015	22.9	.0175	21.0	-.0182	22.6		
28511 22	MILLION GAL	.0013	15.5	.0013	15.5				
28511 24	MILLION GAL	.0014	28.9	.0014	28.7				
28994 --	MILLION LBS	.0009	66.5	.0009	66.2				
28132 --	MIL CU FT	-.0001	94.5	.0164	87.1	-.0204	94.6		
28162 98	THOUSAND TONS	.0015	14.5	-.0014	14.6	.0375	12.6	-.0264	14.4
28199 27	THOUSAND TONS	0.0001	0.3	-.1294	0.6	.1892	0.3	0.0000	0.3
28349 51	MILLION DOL	0.0000	1.2	.0371	1.0	-.0446	1.2		
28349 33	MILLION DOL	0.0000	0.2	0.0000	0.2	0.0000	0.2		
28921 45	MILLION UNITS	0.0000	14.0	-.0189	15.4	.0621	12.1	-.0287	14.0
28443 98	MILLION GAL	-.0022	26.0	.1943	10.7	.0688	8.2	-.2109	26.8
28134 71	MILLION GAL	-.0031	4.5	.0045	4.4	-.0215	4.8	.0042	4.7

VALUE OF SHIPMENTS OF PRODUCTS

1972 PRODUCT CODE	UNIT OF MEASURE	TOTAL GROWTH RATE	1972 VALUE (MIL $.)	GROWTH RATE	1967 VALUE (MIL $.)	GROWTH RATE	1963 VALUE (MIL $.)	GROWTH RATE	1958 VALUE (MIL $
28199 35	THOUSAND TONS	-.0035	2.0	.0330	1.7	.1150	1.1	-.1213	2.1
28122 45	THOUSAND TONS	-.0041	52.5	.0098	50.1	-.0154	53.3	-.0038	55.7
28199 44	MILLION DOL	-.0037	3.8	-.0044	5.3	.1015	3.6	-.0209	4.0
28743 31	THOUSAND TONS	-.0046	16.5	-.0610	22.6	.0722	17.1		
28194 41	THOUSAND TONS	-.0049	4.2	-.0381	5.1	-.1173	9.4	.1330	4.5
28213 75	MILLION LBS	-.0347			65.1	-.0247	69.4		
28743 --	THOUSAND TONS	-.0047	389.7	-.0177	426.0	.0118	406.4		
28342 71	MILLION DOL	-.0052	24.2	-.0196	25.4	-.0020	25.6		
28445 49	THOUS UNITS	-.0056	16.0	.1938	6.6	-.1277	11.4	-.0800	17.3
28913 11	MILLION LBS	-.0056	12.2	-.0819	18.6	.0916	13.1	-.0015	13.2
28332 37	MILLION DOL	-.0067	1.6	.0778	1.1	-.1031	1.7		
28348 41	MILLION DOL	-.0077	15.2	.0282	14.1	-.0498	17.3		
28959 11	MILLION LBS	-.0083	149.4	.0467	118.9	-.1493	227.0	.0623	167.9
28194 --	THOUSAND TONS	-.0092	153.0	-.2839	237.0	.0926	166.3		
28347 13	MILLION DOL	-.0086	39.8	.0191	36.2	-.0421	43.0		
28513 56	MILLION GAL	-.0091	17.6	.0395	14.5	-.1333	22.4	.0229	20.0
28212 13	MILLION LBS	-.0098			224.7	-.0261	249.8	.0034	245.6
28229 93	MILLION LBS	-.0109	862.3	.0738	623.9	-.1726	1288.5	.0510	1004.9
28423 93	MILLION GAL	-.0111	5.3	.0247	4.6	-.0996	7.0	.0246	6.2
28231 15	MILLION LBS	-.0115	52.8	-.0359	63.4	.0199	58.6		
28995 65	MILLION LBS	-.0123	7.4	-.1471	16.4	.0385	14.1	.0989	8.8
28347 51	MILLION DOL	-.0131	16.7	-.0116	17.7	-.0150	18.8		
28411 12	MILLION LBS	-.0131	23.2	.0386	19.2	.1226	17.6	-.0880	27.9
28611 93	MILLION LBS	-.0142	37.9	.1259	26.8	-.1601	41.8	-.0193	46.2
28612 83	THOUSAND TONS	-.0142	5.4				5.8	-.0255	6.6
28199 53	THOUSAND TONS	-.0147	1.3	-.1073	2.3	.0953	1.6	0.0000	1.5
28139 55	THOUSAND TONS	-.0151	2.1	-.0689	3.0	-.0235	3.3	.0488	2.6
28422 53	MILLION DOL	-.0152	16.5	-.0162	17.9				
28655 11	MILLION DOL	-.0158	80.9	-.0138	87.6				
28792 83	MILLION LBS	-.0158	15.9	-.1983	46.4	.1603	25.6	.0592	19.2
28793 65	MILLION LBS	-.0161	5.5	-.1213	10.9	.2606	7.7	.0222	6.9
28199 19	THOUSAND TONS	-.0174	9.7	-.0041	9.9	-.0729	13.4	.0156	12.4
28199 65	THOUSAND TONS	-.0174	1.9	.0515	1.4	.0187	1.3	-.1078	2.3
28411 93	MILLION LBS	-.0173	19.9	-.0173	21.6				
28911 31	MILLION GAL	-.0178	15.4	.0053	15.0	.0248	13.6	-.0724	19.9
28731 39	MILLION LBS	-.0195	55.6	-.1469	72.7	.0068	69.8	-.0095	72.2
28921 17	MILLION LBS	-.0193	96.7	-.0842	150.1	-.0546	187.9	.0846	125.2
28123 61	THOUSAND TONS	-.0196	30.6	.0067	29.6	-.0854	42.3	.0123	39.8
28731 --	MILLION DOL	-.0194	775.9	-.0194	835.9				
28414 11	MILLION LBS	-.0203	9.6	-.0233	10.8	.0246	9.8	-.0520	12.9
28196 45	THOUSAND TONS	-.0213	3.7	-.0544	5.0	.0103	4.8	-.0081	5.0
28332 41	MILLION DOL	-.0213	7.5	-.1400	9.2	.0027	9.1		
28511 27	MILLION GAL	-.0208	7.5	-.0221	8.5	-.0196	9.2	-.0234	10.2
28931 15	MILLION LBS	-.0217	24.7	-.0336	29.3	-.0796	34.3	.0253	33.4
28197 63	THOUSAND TONS	-.0217	11.1	-.0537	15.1				15.1
28232 25	MILLION LBS	-.0225	15.9	-.0514	23.7	-.0129	21.8	.0309	21.7
28341 25	MILLION DOL	-.0221	4.5	.0291	4.3	-.0597	5.5		
28414 --	MILLION DOL	-.0221	51.5	.1139	49.1	.0572	38.5	-.1137	72.6

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VALUE OF SHIPMENTS OF PRODUCTS

1972 PRODUCT CODE	UNIT OF MEASURE	TOTAL GROWTH RATE	1972 VALUE (MIL $)	GROWTH RATE	1967 VALUE (MIL $)	GROWTH RATE	1963 VALUE (MIL $)	GROWTH RATE	1958 VALUE (MIL $
28430 11	MILLION LBS	-.0225			74.2	-.0332	27.7	-.0138	29.7
28731 31	THOUSAND TONS	-.0224	341.9	-.0224	382.9				
28743 13	THOUSAND TONS	-.0218	275.4	-.0582	371.6	.0256	335.8		
28752 25	THOUSAND TONS	-.0222	17.4	.0584	13.1	-.1144	21.3		
28931 65	MILLION LBS	-.0235	24.6	.0180	22.5	-.0270	25.1	-.0605	34.3
28137 --	THOUSAND TONS	-.0243	39.2	-.0373	47.4	-.0076	45.9		
28163 11	THOUSAND TONS	-.0245			2.4	.0220	2.2	-.0601	3.0
28124 23	THOUSAND TONS	-.0252	3.1	-.0718	4.5	.0364	3.9		
28197 25	THOUSAND TONS	-.0250	8.7	-.0743	12.8	-.0188	13.9	.0216	12.4
28222 23	MILLION LBS	-.0252	39.4	-.0387	48.0	.0021	47.5	-.0330	56.3
28348 63	MILLION DOL	-.0260	30.6	-.0123	32.5	-.0433	39.8		
28413 22	MILLION LBS	-.0259	43.4	.0242	38.5	-.0372	44.3	-.0659	62.7
29935 --	MILLION LBS	-.0259	35.7	-.0259	46.7				
28347 53	MILLION DOL	-.0270	6.9	.0032	6.7	-.0632	9.7		
29791 33	MILLION LBS	-.0272	28.2	-.0534	37.1	-.0072	49.0	.0338	41.5
28332 13	MILLION DOL	-.0295	15.4	-.0482	21.6	-.0035	21.3		
28345 41	MILLION DOL	-.0288	15.6	-.0739	22.9	.0306	20.3		
28345 91	MILLION DOL	-.0300	1.9	.0799	1.3	-.1558	2.5		
29732 81	MILLION LBS	-.0313	1.3	-.0282	1.5	-.1013	2.3	.0283	2.0
29513 57	MILLION GAL	-.0319	51.1	.0076	49.2	-.0729	66.6	-.0372	90.5
29513 67	MILLION GAL	-.0321	5.0	.1076	3.0	-.0913	4.4	-.1105	7.9
28437 71	MILLION LBS	-.0329			14.3	-.0035	14.5	-.0556	19.3
29511 21	MILLION GAL	-.0331	110.2	.0289	95.6	-.1349	170.7	-.0067	176.5
29341 37	MILLION DOL	-.0340	4.1	-.0427	5.1	-.0231	5.5		
28731 55	THOUSAND TONS	-.0351	137.[illegible]	-.0350	163.7				
28133 31	THOUSAND TONS	-.0357	15.8	-.0257	18.4	-.0389	21.1	-.0431	26.3
28414 51	MILLION LBS	-.0365	27.1	.0107	25.7	.0607	20.3	-.1494	45.6
29934 11	MILLION LBS	-.0366	29.3	-.0366	35.3				
28197 14	THOUSAND TONS	-.0397	5.0	-.1148	9.2	.0632	7.2		
29731 11	THOUSAND TONS	-.0414	37.1	-.0414	45.7				
29914 91	MILLION GAL	-.0432	26.7	-.0432	33.3				
28232 11	MILLION LBS	-.0439	11.9	-.1498	26.4	-.0083	27.3	.0432	22.1
28199 71	THOUSAND AV CS	-.0452	8.4	-.2538	36.3	.0436	30.6	.1385	16.0
29343 45	MILLION DOL	-.0447	11.0	-.0293	12.7	-.0648	16.6		
28347 41	MILLION DOL	-.0451	3.5	-.0433	4.3	-.0509	5.3		
29441 41	MILLION LBS	-.0445	1.9	-.1526	4.1	-.0494	5.0	.0679	3.5
28793 15	MILLION LBS	-.0453	8.1	-.0542	16.7	.0362	9.5	-.0933	15.5
29342 61	MILLION DOL	-.0464	31.7	-.1089	56.4	.0379	48.6		
28424 42	MILLION GAL	-.0474	10.9	-.0857	16.9	-.1358	30.3	.0730	21.3
28197 92	THOUSAND TONS	-.0484			1.6	-.0867	2.3	-.0165	2.5
28516 45	MILLION GAL	-.0482	37.3	.0613	27.7	-.1694	59.2		
29794 91	MILLION LBS	-.0494	7.1	-.0494	9.1				
28348 33	MILLION DOL	-.0547	17.2	-.1131	24.1	-.1042	21.9		
29913 14	MILLION LBS	-.0551	4.3	-.0876	6.8	-.0242	7.5	-.0462	9.5
28752 31	THOUSAND TONS	-.0555	12.2	-.0730	13.5	-.0981	20.4		
29424 33	MILLION DOL	-.0560	13.6	.0744	9.5	-.1094	15.1	-.1334	33.9
28443 34	MILLION GAL	-.0574	19.1	-.0814	29.2	-.0906	42.7	-.3046	43.7
28414 31	MILLION LBS	-.0595	5.2	-.1483	11.6	.1840	8.4	-.0794	12.1

VALUE OF SHIPMENTS OF PRODUCTS

1972 PRODUCT CODE	UNIT OF MEASURE	TOTAL GROWTH RATE	1972 VALUE (MIL $.)	GROWTH RATE	1967 VALUE (MIL $.)	GROWTH RATE	1963 VALUE (MIL $.)	GROWTH RATE	1958 VALUE (MIL $
28199 12	THOUSAND TONS	-.0595	24.6	-.1433	53.2	-.0336	51.0	.0098	58.1
28344 67	MILLION DOL	-.0603	6.4	-.1497	0.9	.0648	0.7		
28124 93	MILLION DOL	-.0561	6.0	-.0636	8.2	-.0729	11.1		
28715 33	MILLION DOL	-.0657	4.2	-.0657	5.9				
28347 21	MILLION DOL	-.0705	3.0	-.0128	3.2	-.1382	5.9		
28732 82	MILLION LBS	-.0741	1.6	-.1437	3.6	-.2366	10.6	.1766	4.7
28791 19	MILLION LBS	-.0755	1.2	-.0734	1.4	-.0171	1.5	-.1606	3.6
28423 96	MILLION DOL	-.0777	11.2	-.1117	20.2	-.0346	23.2		
28343 29	MILLION DOL	-.0790	3.4	.0160	3.3	-.1743	7.1		
28742 15	THOUSAND TONS	-.0846	18.4	-.1735	47.7	-.0485	58.2	-.0170	63.4
28214 93	MILLION LBS	-.0917			11.4	-.1749	24.6	-.0192	27.1
28731 57	THOUSAND TONS	-.0930	34.6	-.0930	55.4				
28611 13	MILLION LBS	-.0949	1.0	-.3093	6.3	.3161	2.1	-.1335	4.3
28197 83	THOUSAND TONS	-.0996			2.1	.2729	0.8	-.3174	5.4
28612 1	THOUSDRUMS17LBS	-.1035	2.6	-.2128	8.6	-.1355	15.4	.0512	12.0
28411 15	MILLION LBS	-.1061	4.1	.0131	3.9	-.1953	9.3	-.1394	19.7
28743 17	THOUSAND TONS	-.1071	2.2	-.1791	5.9	-.0083	6.1		
28791 61	MILLION LBS	-.1086	1.4	-.3291	7.3	.7383	0.8	-.3069	5.0
28344 31	MILLION DOL	-.1112	2.7	-.1711	6.9	-.0302	7.8		
28344 55	MILLION DOL	-.1130	1.7	-.1242	3.3	-.0987	5.0		
28515 99	MILLION GAL	-.1149	1.1	-.0173	1.2	-.2235	3.3		
28444 31	MILLION LBS	-.1196	2.7	-.1973	2.1	-.0999	3.2	-.0484	4.1
28441 33	MILLION LBS	-.1283	4.3	-.0649	6.7	-.1797	14.9		
28348 22	MILLION DOL	-.1336	2.2	-.1222	3.2	-.2047	8.2		
28232 31	MILLION LBS	-.1417	19.4	-.2419	77.5	-.1271	133.5	-.0382	162.2
28417 13	MILLION LBS	-.1423	4.2	-.2713	20.4	.0694	15.6	-.1540	36.0
28213 77	MILLION LBS	-.1428			37.9	-.1428	70.2		
28731 33	THOUSAND TONS	-.1426	1.9	-.1426	4.1				
28913 43	MILLION LBS	-.1428	3.9	-.1497	8.5	-.1352	15.2		
28791 22	MILLION LBS	-.1563	1.4	-.1459	2.2				10.8
28743 51	THOUSAND TONS	-.1590	0.8	-.1755	2.1	-.1378	3.8		
28211 11	MILLION DOL	-.1723			16.1	-.1723	34.3		
28197 51	THOUSAND TONS	-.2166	3.4	-.3752	4.2	-.1909	9.8	-.0429	12.2
28199 42	THOUSAND TONS	-.3957			0.2	-.3957	1.5		
28211 91	MILLION DOL	-.4054			1.9	-.4604	14.7		

APPENDIX C

FUTURE GROWTH OF PRODUCT

TABLE C-1. FUTURE GROWTH OF PRODUCT BY SECTOR

Sector Number	SIC Number	Sector Name*	Annual Rates of Change 1970-1985
3.01	2011-2099	Food and Kindred Products	2.81
3.02	21110-2141-	Tobacco Manufactures	2.69
3.03	3111-31210	Leather Tanning and Industrial Leather Products	2.36
3.04	31310-31990	Footwear and Other Leather Products	2.72
3.05	2211-2284	Fabrics and Yarns and Thread	2.76
3.06	22710-22790	Soft Floor Coverings	3.87
3.07	22910-2299-	Tire Cord and Miscellaneous Textile Goods	3.44
3.08	2251-22590	Knitted Apparel	3.59
3.09	2311-2389	Apparel made from purchased materials	3.39
3.10	23910-23990	Miscellaneous Fabricated Textile Products	3.54
4.01	2421-24290	Sawmills and Planing Mills	2.09
4.02	2432	Veneer and Plywood	3.97
4.03	2411	Other Lumber and Wood Products	3.74
4.04	2441-24450	Wooden Containers	2.86
4.05	2511-25190	Household Furniture	3.05
4.06	25210-25990	Other Furniture and Fixtures, N.E.C.	3.77
4.07	2611-2661	Pulp and Paper and Paper Products	3.43
4.08	26510-2655-	Paperboard Containers and Boxes	3.65
5.01	2911-29990	Petroleum Refining and Related Products	3.21
5.02	29510-2952-	Paving Mixtures and Asphalt Products	5.52
5.03	2812	Alkalies and Chlorine	3.00
5.03	2813	Industrial Gases	3.83
5.03	2815	Cyclic Intermediates and Crudes	4.69
5.03	2816	Inorganic Pigments	3.49
5.03	2818	Industrial Organic Chemicals	3.67
5.03	2819	Industrial Inorganic Chemicals	3.33
5.04	2871	Fertilizers	4.08

TABLE C-1. (Continued)

Sector Number	SIC Number	Sector Name*	Annual Rates of Change 1970-1985
5.04	28722	Fertilizers, Mixing Only	3.90
5.05	28790	Agricultural Chemicals, except Fertilizers	3.99
5.06	2861	Gum and Wood Chemicals	3.81
5.06	2891	Adhesives and Gelatin	4.20
5.06	28921	Explosives, except Government-owned	3.23
5.06	28930	Printing Ink	3.96
5.06	28950	Carbon Black	4.30
5.06	2899	Chemical Preparations, N.E.C.	4.34
5.07	2821	Plastics Materials and Resins	4.59
5.07	28220	Synthetic Rubber	3.87
5.08	2823	Cellulosic Man-made Fibers	3.12
5.08	2824	Organic Fibers, Noncellulosic	5.50
5.09	2831	Biological Products	5.08
5.09	2833	Medicinals and Botanicals	3.44
5.09	2834	Pharmaceutical Preparations	[illegible].88
5.10	2841	Soap and Other Detergents	2.92
5.10	2842	Polishes and Sanitation Goods	3.91
5.10	28430	Surface Active and Finishing Agents	3.92
5.11	2844	Toilet Preparations	3.23
5.12	2851	Paints and Allied Products	3.27
5.13	3011	Tires and Inner Tubes	3.36
5.14	30210-3069	All Other Rubber Products	4.17
5.15	3079-	Manufactured Plastic Products	5.34
6.01	3211-3231	Glass and Glass Products	3.64
6.02	32410-3275	Hydraulic Cement and Lime and Gypsum Products	4.02
6.03	3251-32970	Nonclay Refractories	4.59
6.04	3281-32990	Other Stone and Nonmetallic Mineral Products	3.72
7.01	3312-3391	Primary Iron and Steel	3.05
8.01	34110	Metal Cans	2.72

TABLE C-1. (Continued)

Sector Number	SIC Number	Sector Name*	Annual Rates of Change 1970-1985
8.02	3491	Metal Barrels and Drums and Pails	3.44
8.03	34310-34320	Metal Sanitary Ware and Plumbing Fittings	3.35
8.04	3433	Nonelectric Heating Equipment	4.31
8.05	3441-3449	Fabricated Structural Metal Products	3.80
8.06	34510-3461	Screw Machine Products and Stamping, etc.	3.65
8.07	3421-34990	Other Fabricated Metal Products	3.09
9.01	3511-3519	Engines and Turbines	3.54
9.02	3561-35690	General Industrial Machinery and Equipment	3.74
9.03	3599	Machine Shop Products	3.67
10.01	3522	Farm Machinery	3.57
10.02	3531	Construction Machinery	3.89
10.03	3532	Mining Machinery	3.50
10.04	3533	Oil Field Machinery	4.52
10.05	35340-3536	Materials Handling and Machinery	5.95
10.06	35370	Industrial Trucks and Tractors	3.53
10.07	3541-3548	Metalworking Machinery	3.81
10.08	3551-3559	Special Industry Machinery	3.63
11.01	3711-37150	Motor Vehicles and Parts	3.28
11.02	3721-3729	Aircraft and Parts	3.32
11.03	3731-3732	Ship and Boat Building and Repair	2.87
11.04	3741-3742	Locomotives and Rail and Streetcars	3.66
11.05	37510-3799	Motorcycles and Bicycles and Trailer Coaches	3.49
12.01	3611	Electrical Measuring Instruments	3.85
12.02	3621	Electric Motors and Generators	3.88
12.03	3612-3629	Industrial Controls and Transformers	5.11
12.04	36410	Electric Lamps	4.11
12.05	3642-3644	Lighting Fixtures and Wiring Devices	4.48
12.06	3671-3679	Electronic Components and Accessories	3.42
12.07	3691-3699	Miscellaneous Electrical Machinery and Equipment	3.59

TABLE C-1. (Continued)

Sector Number	SIC Number	Sector Name*	Annual Rates of Change 1970-1985
13.01	3581-3589	Service Industry Machinery	4.06
13.02	3631-3639	Household Applicances	2.83
13.03	3651-3662	Radio and TV and Communication Equipment	3.27
14.01	3811-3822	Scientific Instruments and Measures and Controls	4.23
14.02	38410-38430	Medical and Surgical and Dental Instruments and Supplies	4.00
14.03	3871-38720	Watches and Clocks and Parts	1.97
14.04	3831-3851	Optical and Opthalmic Goods	3.26
14.05	3861	Photographic Equipment and Supplies	3.82
15.01	3571	Computing and Related Machines	3.67
15.02	35720-3579	All Other Office and Business Machines	3.80
16.01	19110-19990	Ordnance and Accessories	2.78
16.02	3911-3999	Other Miscellaneous Products	3.50

* Sectors 5.03 to 5.12 (SIC group 28) are specified in greater detail because of their usage in calculation of the composite index for major group 28.

Source: PREVIEWS 85 program output.

APPENDIX D

AN ALTERNATIVE DISPERSION INDEX

The alternative index is made up of two parts that have a multiplicative relationship:

$$I_i = A_i \times B_i \ .$$

The first part (A) measures the overall degree to which products of a subject sector enter into other products. The second part (B) corrects that measurement for the relative frequency with which other sectors depend on the sector in question. The derivation and meaning of these two elements is discussed below.

A_i: The Overall Measure

The degree to which a given row sector's output reaches final demand through the output of a given column-sector is a function of the inverse coefficient. When the inverse matrix $(I-A)^{-1}$ is multiplied by the final demand vector (D), these relationships are quantified in terms of dollar values. Total output of the row-sector (TO_i) is the row-sum of these values, and measures the value of output that must be produced and sold within the economy for every sector to satisfy its own final demand.

In the context of this study, whether or not productive personnel in other sectors or consumers of other sectors' output are actually exposed to the given sectors' output depends on whether the output of the subject sector and many of the intermediate linking sectors are goods or services. To the extent that they are services, physical exposures cannot occur. No effort has been made to correct for this fact. The overall measure (A) is established as follows:

$$A_i = \frac{TO_i}{\sum_i TO_i} \ .$$

B_i = The Correction Factor

Exposure to sector output is also a function of (1) the number of nonzero cells on that sector's row in the inverse matrix, and (2) whether or not those values are large or small. This is to say that a single large value on a given row with many zero values would imply less exposure than would a large number of moderate-sized cells. To correct for this, we make B_i a function of the number of nonzero cells (n) as a proportion of the total number of cells (N) on one row of the inverse matrix. The simplest expression of this relationship is:

$$B_i''' = {}^{n}/N \ .$$

However, to reduce the range of variation the following form was adopted:

$$B_i'' = {}^{1}/\log {}^{N}/n \ .$$

If N = n, this fraction would lead to an anomaly. Therefore the ratio was restated:

$$B_i' = {}^{1}/\log {}^{N+1}/n \ .$$

And, to eliminate variations in the ratio because of trivial cel values we redefined n:

$$B_i = {}^{1}/\log {}^{N+1}/n, \text{ where } n \geq .0001 \ .$$

Calculations for this index have been made for a variety of values of n. Results are reported for a representative value, n = 0.001, because it provides a good range of values for B_i. The results of this calculation are presented in Table D-1 and may be incorporated into the overall calculation of the ranking index as time and funds permit.

TABLE D-1. TOP 25 INDUSTRIAL SECTORS CALCULATED USING THE ALTERNATIVE DISPERSION INDEX

Rank	Sector Number	Sector Name	Dispersion Index
1	20.01	Wholesale and Retail Trade	7.30754
2	3.01	Food and Kindred Products	4.64971
3	20.02	Finance and Insurance	3.19617
4	11.01	Motor Vehicles and Parts	2.84397
5	20.03	Real Estate and Rental	2.79096
6	20.05	Other Business and Professional Services	1.60040
7	19.05	Maintenance and Repair Construction	1.58006
8	21.08	Educational Services and Nonprofit Organizations	1.51473
9	5.01	Petroleum Refining and Related Products	1.19114
10	1.01	Livestock and Livestock Products	1.16835
11	7.01	Primary Iron and Steel	1.08785
12	1.02	Field and Orchard Crops	1.06884
13	18.02	Electric Power	1.04966
14	18.01	Telecommunications	0.97066
15	20.04	Advertising	0.96139
16	17.03	Motor Freight and Warehouse	0.81997
17	18.03	Gas	0.69152
18	21.01	Wholesale and Retail Trade	0.65928
19	21.04	Personal and Repair Services except Cars	0.63705
20	17.01	Railroads and Related Services	0.62623
21	2.06	Stone and Clay Mining	0.62251
22	4.07	Pulp and Paper Products except Containers	0.62006
23	5.03	Industrial Inorganic and Organic Chemicals	0.55931
24	13.03	Radio and TV Communication Equipment	0.55725
25	21.05	Automobile Repair and Services	0.53242

Source: Battelle calculations.

APPENDIX E

STRUCTURAL CHANGE INDICES

TABLE E-1. STRUCTURAL CHANGE INDICES BY SECTOR

Sector Number	Sector Name	Technical Change Index	Kendall Coefficient
1.01	Livestock and Livestock Products	.002708	.9840
1.02	Field and Orchard Crops	.001450	.9901
1.03	Forestry and Fishery Products	.012560	.9846
1.04	Agriculture, Forestry, and Fishery Services	.010354	.9923
2.01	Iron and Ferroalloys Ores	.006959	.9262
2.02	Copper Ores	.000933	.9864
2.03	Nonferrous Ores, except Copper	.005985	.9936
2.04	Coal Mining	.004156	.9745
2.05	Crude Petrol and Natural Gas	.010227	.9786
2.06	Stone and Clay Mining	.005057	.9710
2.07	Chemical and Fertilizer Minerals	.000832	.9916
3.01	Food and Kindred Products	.002084	.9712
3.02	Tobacco Manufactures	.004799	.9818
3.03	Leather Tanning and Industrial Leather Products	.002357	.9781
3.04	Footwear and Leather Products	.003084	.9771
3.05	Fabrics, Yarns, and Threads	.007304	.9793
3.06	Soft Floor Coverings	.006704	.9685
3.07	Tire Cord and Miscellaneous Textile Goods	.007989	.9448
3.08	Knitted Apparel	.001653	.9771
3.09	Apparel from purchased material	.003243	.9668
3.10	Miscellaneous Fabricated Textile Products	.003628	.9874
4.01	Sawmills and Planing Mills	.010340	.9277
4.02	Veneer and Plywood	.008928	.9695
4.03	Lumber and Wood Products except Containers	.007825	.9285
4.04	Wooden Containers	.005507	.9888
4.05	Household Furniture	.004928	.9733
4.06	Other Furniture and Fixtures	.002407	.9514
4.07	Pulp and Paper Products except Containers	.002124	.9779
4.08	Paperboard Containers and Boxes	.003051	.9740

TABLE E-1. (Continued)

Sector Number	Sector Name	Technical Change Index	Kendall Coefficient
5.01	Petroleum Refining and Related Products	.002088	.9949
5.02	Paving Mix and Asphalt Products	.011441	.9344
5.03	Industrial Inorganic and Organic Chemicals	.004832	.9749
5.04	Fertilizers	.002467	.9878
5.05	Agricultural Chemicals except Fertilizers	.005966	.9678
5.06	Miscellaneous Chemical Products	.004529	.9749
5.07	Plastics Materials and Resins	.005263	.9621
5.08	Organic Man-made Fibers	.010021	.9622
5.09	Drugs	.005195	.9862
5.10	Cleaning Preparations	.002725	.9729
5.11	Toilet Preparations	.000875	.9769
5.12	Paints and Allied Products	.002160	.9837
5.13	Tires and Inner Tubes	.002028	.9895
5.14	Other Rubber Products	.002548	.9677
5.15	Manufacturing Plastics Products	.003070	.9913
6.01	Glass and Glass Products	.001556	.9794
6.02	Cement and Lime and Gypsum Products	.002827	.9541
6.03	Clay and Cement Products and Refractories	.001653	.9702
6.04	Other Nonmetal Mineral Products	.010575	.9461
7.01	Primary Iron and Steel	.002320	.9815
7.02	Primary Copper	.000939	.9734
7.03	Primary Aluminum	.003790	.9914
7.04	Other Primary Nonferrous Metals	.003934	.9971
8.01	Metal Cans	.002401	.9922
8.02	Metal Barrels, Drums, and Pails	.001203	.9972
8.03	Metal Sanitation and Plumbing Products	.000273	.9882
8.04	Nonelectric Heating Equipment	.007272	.9405
8.05	Fabricated Structural Metal Products	.001426	.9604
8.06	Screw Machine Products and Stamping	.002136	.9827
8.07	Other Fabricated Metal Products	.002587	.9744
9.01	Engines and Turbines	.001744	.9706

TABLE E-1. (Continued)

Sector Number	Sector Name	Technical Change Index	Kendall Coefficient
9.02	General Industrial Machinery and Equipment	.000978	.9854
9.03	Machine Shop Products	.004282	.9696
10.01	Farm Machinery	.009752	.9763
10.02	Construction Machinery	.001844	.9908
10.03	Mining Machinery	.003022	.9899
10.04	Oil Field Machinery	.008979	.9453
10.05	Material Handling Machinery except Trucks	.003486	.9798
10.06	Industrial Trucks and Tractors	.001617	.9872
10.07	Metalworking Machinery	.002833	.9760
10.08	Special Industry Machinery	.005170	.9724
11.01	Motor Vehicles and Parts	.001298	.9701
11.02	Aircraft and Parts	.007528	.9403
11.03	Ship and Boat Building and Repairs	.005925	.9409
11.04	Locomotives and Rail and Streetcars	.003751	.9443
11.05	Cycles, Trailers, etc.	.008605	.9267
12.01	Electric Measuring Instruments	.003192	.9466
12.02	Electric Motors and Generators	.003912	.9830
12.03	Industrial Controls, etc.	.002051	.9510
12.04	Electric Lamps	.001236	.9952
12.05	Light Fixtures and Wiring Devices	.006356	.9779
12.06	Electronic Components and Accessories	.003544	.9320
12.07	Miscellaneous Electrical Machinery	.002589	.9613
13.01	Service Industry Machinery	.002761	.9684
13.02	Household Appliances	.003273	.9720
13.03	Radio, TV, and Communication Equipment	.002692	.9640
14.01	Scientific Instruments, etc.	.012093	.9812
14.02	Medical, Surgical, and Dental Instruments	.004601	.8912
14.03	Watches, Clocks, and Parts	.010322	.9442
14.04	Optical and Opthalmic Goods	.002581	.9796
14.05	Photographic Equipment and Supplies	.002528	.9914
15.01	Computing and Related Machines	.005817	.9851

TABLE E-1. (Continued)

Sector Number	Sector Name	Technical Change Index	Kendall Coefficient
15.02	Other Office and Business Machines	.003380	.9831
15.03	Office Supplies	.003049	.9989
16.01	Ordnance and Accessories	.005265	.9695
16.02	Other Miscellaneous Products	.001002	.9761
17.01	Railroads and Related Services	.004544	.9354
17.02	Local and Highway Passenger Transport	.007280	.9704
17.03	Motor Freight and Warehouse	.006702	.9474
17.04	Water Transportation	.004165	.9425
17.05	Air Transport	.003787	.9806
17.06	Pipelines	.001872	.9611
17.07	Transportation Services	.004480	.9804
18.01	Telecommunications	.003763	.9842
18.02	Electric Power	.001844	.9980
18.03	Gas	.003209	.9354
18.04	Water and Sanitary Services	.002901	.9775
19.01	New Construction, Nonfarm Residential	.002437	.9286
19.02	New Construction, Nonresidential Buildings	.009741	.9570
19.03	New Construction, Public Utilities	.003575	.9855
19.04	New Construction, Highways and Other	.001303	.9880
19.05	Maintenance and Repair Construction	.003110	.9766
20.01	Wholesale and Retail Trade	.002060	.9857
20.02	Finance and Insurance	.002314	.9968
20.03	Real Estate and Rental	.001031	.9814
20.04	Advertising	.002779	.9899
20.05	Other Business and Professional Services	.001528	.9872
20.06	Business Travel, Entertainment, and Gifts	.003557	.9775
21.01	Printing and Publishing	.001377	.9879
21.02	Radio and TV Broadcasting	.003656	.9702
21.03	Hotels and Lodging Places	.013158	.9975
21.04	Personal and Repair Services, except Cars	.003131	.9223
21.05	Automobile Repair and Service	.003122	.9611

TABLE E-1. (Continued)

Sector Number	Sector Name	Technical Change Index	Kendall Coefficient
21.06	Amusements	.001733	.9872
21.07	Medical and Health Services	.002418	.9680
21.08	Educational Services and Nonprofit Organizations	.003383	.9699
22.01	Post Office	.003142	.9820
23.01	Import Noncompetitive Products	.000000	1.0000

Source: Battelle estimates.

APPENDIX F

COMPOSITE PRODUCT RANKING

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COMPOSITE PRODUCT RANKING

PRODUCT	WEIGHTS COMP INDEX	2.900 HISTORICAL GROWTH		2.430 FUTURE GROWTH		2.360 DISPERSION		1.350 TECHNICAL CHANGE		1.130 VALUE	
		WEIGHTED	UNWGHTD	WEIGHTED	UNWGHTD	WEIGHTED	UNWGHTD	WEIGHTED	UNWGHTD	WEIGHTED	UNWGHTD
28241 33	6.16175	1.60425	.5531	2.43000	1.0000	.71234	.3018	1.35000	1.0000	.06516	.0576
28242 --	6.15269	1.29203	.4426	2.43000	1.0000	.71234	.3018	1.35000	1.0000	.37832	.3348
28692 13	5.96294	1.07175	.3695	.86255	.3549	2.36000	1.0000	.53851	.3989	1.13000	1.0000
28241 --	5.86354	1.05577	.3640	2.43000	1.0000	.71234	.3018	1.35000	1.0000	.32143	.2844
28392 99	5.85932	1.60425	.5531	1.35411	.5572	2.36000	1.0000	.53851	.3989	.00205	.0019
28219 13	5.84724	2.90000	1.0000	1.58599	.6526	.71234	.3018	.64770	.4797	.00122	.0010
28242 51	5.83369	1.18633	.4097	2.43000	1.0000	.71234	.3018	1.35000	1.0000	.15902	.1407
28241 15	5.76776	1.01320	.3514	2.43000	1.0000	.71234	.3018	1.35000	1.0000	.25622	.2267
28794 71	5.75584	1.53651	.5539	1.02949	.4236	2.36000	1.0000	.75097	.5562	.00897	.0079
28995 --	5.67179	1.09005	.3758	1.35411	.5572	2.36000	1.0000	.53851	.3989	.32911	.2912
28792 95	5.66591	1.44199	.4972	1.02949	.4236	2.36000	1.0000	.75097	.5562	.08356	.0739
28242 31	5.63121	1.07179	.3695	2.43000	1.0000	.71234	.3018	1.35000	1.0000	.06909	.0611
28914 99	5.60281	1.46713	.5059	1.22425	.5038	2.36000	1.0000	.53851	.3989	.01292	.0114
28905 13	5.54277	1.28887	.4444	1.35411	.5572	2.36000	1.0000	.53851	.3989	.00119	.0011
28914 11	5.49974	1.28887	.4444	1.22425	.5038	2.36000	1.0000	.53851	.3989	.08811	.0779
28395 39	5.49611	1.23403	.4255	1.35411	.5572	2.36000	1.0000	.53851	.3989	.00946	.0083
28395 91	5.48489	1.21118	.4176	1.35411	.5572	2.36000	1.0000	.53851	.3989	.02109	.0186
28242 71	5.48272	.97908	.3372	2.43000	1.0000	.71234	.3018	1.35000	1.0000	.01230	.0108
28914 --	5.47948	1.21932	.4203	1.22425	.5038	2.36000	1.0000	.53851	.3989	.13870	.1227
28995 12	5.46877	1.19975	.4137	1.35411	.5572	2.36000	1.0000	.53851	.3989	.00635	.0056
28395 41	5.44954	1.18833	.4097	1.35411	.5572	2.36000	1.0000	.53851	.3989	.00709	.0062
28791 49	5.42368	1.25230	.4318	1.02949	.4236	2.36000	1.0000	.75097	.5562	.03092	.0273
28995 77	5.42319	1.13575	.3916	1.35411	.5572	2.36000	1.0000	.53851	.3989	.03482	.0309
28995 33	5.41823	1.15960	.3999	1.35411	.5572	2.36000	1.0000	.53851	.3989	.00501	.0044
28995 81	5.41752	1.15176	.3971	1.35411	.5572	2.36000	1.0000	.53851	.3989	.00914	.0081
28995 95	5.39646	1.05806	.3648	1.35411	.5572	2.36000	1.0000	.53851	.3989	.08629	.0763
28995 63	5.38592	1.12433	.3877	1.35411	.5572	2.36000	1.0000	.53851	.3989	.01937	.0171
28992 92	5.38371	1.13120	.3900	1.35411	.5572	2.36000	1.0000	.53851	.3989	.00649	.0057
28905 35	5.37973	1.08320	.3735	1.35411	.5572	2.36000	1.0000	.53851	.3989	.04351	.0385
28791 43	5.37746	1.20605	.4156	1.02949	.4236	2.36000	1.0000	.75097	.5562	.03040	.0259
28914 93	5.37507	1.23859	.4271	1.22425	.5038	2.36000	1.0000	.53851	.3989	.01372	.0121
28995 11	5.36370	1.13835	.3921	1.35411	.5572	2.36000	1.0000	.53851	.3989	.00203	.0018
28995 29	5.35187	1.09005	.3759	1.35411	.5572	2.36000	1.0000	.53851	.3989	.00820	.0072
28793 71	5.34284	1.19746	.4129	1.02949	.4236	2.36000	1.0000	.75097	.5562	.00412	.0036
28915 --	5.33369	1.18604	.4089	1.22425	.5038	2.36000	1.0000	.53851	.3989	.02499	.0221
28992 --	5.32489	1.04205	.3593	1.35411	.5572	2.36000	1.0000	.53851	.3989	.03022	.0267
28995 19	5.32421	1.06720	.3680	1.35411	.5572	2.36000	1.0000	.53851	.3989	.00439	.0039
28995 15	5.32376	1.05720	.3640	1.35411	.5572	2.36000	1.0000	.53851	.3989	.00324	.0029
28995 49	5.32181	1.06035	.3656	1.35411	.5572	2.36000	1.0000	.53851	.3989	.00894	.0079
28992 31	5.30318	1.38257	.4767	1.00147	.4122	2.36000	1.0000	.53851	.3989	.01643	.0145
28992 11	5.29872	1.04205	.3593	1.35411	.5572	2.36000	1.0000	.53851	.3989	.00359	.0031
28392 23	5.29172	1.03561	.3571	1.35411	.5572	2.36000	1.0000	.53851	.3989	.00847	.0075
28995 51	5.28585	1.02378	.3530	1.35411	.5572	2.36000	1.0000	.53851	.3989	.01045	.0092
28995 72	5.27568	1.01691	.3506	1.35411	.5572	2.36000	1.0000	.53851	.3989	.00355	.0031
28995 99	5.27073	1.00322	.3459	1.35411	.5572	2.36000	1.0000	.53851	.3989	.01489	.0131
28391 11	5.26768	.98721	.3404	1.35411	.5572	2.36000	1.0000	.53851	.3989	.02789	.0246
28395 97	5.26755	1.00549	.3467	1.35411	.5572	2.36000	1.0000	.53851	.3989	.00945	.0083

COMPOSITE PRODUCT RANKING

PRODUCT	WEIGHTS COMP INDEX	2.938 HISTORICAL GROWTH WEIGHTED	HISTORICAL GROWTH UNWGHTD	2.431 FUTURE GROWTH WEIGHTED	FUTURE GROWTH UNWGHTD	2.361 DISPERSION WEIGHTED	1.356 DISPERSION UNWGHTD	1.155 TECHNICAL CHANGE WEIGHTED	TECHNICAL CHANGE UNWGHTD	VALUE WEIGHTED	VALUE UNWGHTD
28995 59	5.25616	.98651	.3412	1.35411	.5572	2.36388	1.0000	.53851	.3989	.01424	.0126
28992 51	5.25196	.98615	.3415	1.35411	.5572	2.36388	1.0000	.53851	.3989	.01299	.0126
28796 --	5.25119	1.07179	.3695	1.12949	.4236	2.36388	1.0000	.75397	.5562	.01785	.0335
28913 75	5.24465	1.11977	.3861	1.22425	.5138	2.36388	1.0000	.53851	.3989	.01432	.0056
28796 15	5.24475	1.11147	.3798	1.12949	.4236	2.36388	1.0000	.75397	.5562	.00642	.0056
28913 55	5.22747	1.11147	.3798	1.22425	.5138	2.36388	1.0000	.53851	.3989	.01319	.0029
28992 41	5.22726	.97121	.3349	1.35411	.5572	2.36388	1.0000	.53851	.3989	.01343	.0333
28996 11	5.21775	.95752	.3301	1.35411	.5572	2.36388	1.0000	.53851	.3989	.01341	.0136
28793 99	5.21215	1.06949	.3687	1.12949	.4236	2.36388	1.0000	.75397	.5562	.01211	.0119
28793 57	5.20666	1.05964	.3654	1.12949	.4236	2.36388	1.0000	.75397	.5562	.01136	.0112
28992 57	5.19332	.92779	.3199	1.35411	.5572	2.36388	1.0000	.53851	.3989	.00292	.0025
28996 --	5.19279	.91637	.3159	1.35411	.5572	2.36388	1.0000	.53851	.3989	.01363	.0122
28791 --	5.18148	.95974	.3319	1.12949	.4236	2.36388	1.0000	.75397	.5562	.09616	.0759
28914 45	5.15799	1.[illegible]	.35[illegible]	1.22425	.5138	2.36388	1.0000	.53851	.3989	.01822	.0161
28651 11	5.15762	1.08091	.3727	.85255	.3549	2.36388	1.0000	.53851	.3989	.31565	.2793
28199 14	5.15239	1.79519	.6152	.61735	.1717	2.36388	1.0000	.58425	.4327	.03571	.0316
28796 12	5.14266	.99475	.3435	1.12949	.4236	2.36388	1.0000	.75397	.5562	.00585	.0051
28459 11	5.14261	.83531	.2749	1.31751	.5419	2.36388	1.0000	.53851	.3989	.03157	.0275
28796 15	5.14196	.99866	.3443	1.12949	.4236	2.36388	1.0000	.75397	.5562	.01271	.0123
28996 55	5.14174	.98857	.3457	1.35411	.5572	2.36388	1.0000	.53851	.3989	.00149	.0013
28913 51	5.13569	1.01177	.3487	1.22425	.5138	2.36388	1.0000	.53851	.3989	.03586	.0351
28795 15	5.12826	.95725	.3434	1.12949	.4236	2.36388	1.0000	.75397	.5562	.00159	.0035
28134 46	5.12713	1.27161	.4731	.88159	.3625	2.36388	1.0000	.58425	.4327	.02719	.0239
28913 41	5.12177	.99645	.3435	1.22425	.5138	2.36388	1.0000	.53851	.3989	.01166	.0114
28913 76	5.11577	.98651	.3412	1.22425	.5138	2.36388	1.0000	.53851	.3989	.01301	.0026
28933 45	5.10577	1.19516	.4133	1.21167	.4122	2.36388	1.0000	.53851	.3989	.00955	.0084
28199 91	5.10491	1.72535	.5949	.61735	.1717	2.36388	1.0000	.58425	.4327	.01785	.0163
28793 59	5.09403	.94151	.3245	1.12949	.4236	2.36388	1.0000	.75397	.5562	.01716	.0162
28994 11	5.08821	.87956	.2956	1.35411	.5572	2.36388	1.0000	.53851	.3989	.01605	.0153
28174 --	5.08329	1.13864	.3924	.88159	.3625	2.36388	1.0000	.58425	.4327	.09971	.0884
28972 --	5.08218	1.13327	.3911	1.21167	.4122	2.36388	1.0000	.53851	.3989	.03391	.0272
28792 44	5.07375	.91366	.3157	1.12949	.4236	2.36388	1.0000	.75397	.5562	.01163	.0114
28696 11	5.07912	1.19517	.4121	.86255	.3549	2.36388	1.0000	.53851	.3989	.01189	.0011
28376 --	5.05255	1.13476	.3926	1.21167	.4122	2.36388	1.0000	.53851	.3989	.01428	.0125
28937 --	5.07795	1.11461	.3873	1.21167	.4122	2.36388	1.0000	.53851	.3989	.01757	.0151
28913 11	5.02564	.92119	.3176	1.22425	.5138	2.36388	1.0000	.53851	.3989	.01249	.0122
28791 19	5.02436	.87295	.3011	1.12949	.4236	2.36388	1.0000	.75397	.5562	.01153	.0112
28752 45	5.02136	.87754	.3026	1.12949	.4236	2.36388	1.0000	.75397	.5562	.01316	.0124
28793 45	5.01379	.87774	.3026	1.12949	.4236	2.36388	1.0000	.75397	.5562	.01119	.0119
28791 17	4.99968	.85215	.2939	1.12949	.4236	2.36388	1.0000	.75397	.5562	.01583	.0051
28792 41	4.99925	.84502	.2915	1.12949	.4236	2.36388	1.0000	.75397	.5562	.01122	.0112
28697 --	4.97571	1.04495	.3572	.85255	.3549	2.36388	1.0000	.53851	.3989	.14935	.1321
28691 11	4.96364	1.11291	.3837	.85255	.3549	2.36388	1.0000	.53851	.3989	.09572	.0867
28134 [illegible]	4.96151	1.12495	.3892	.88159	.3625	2.36388	1.0000	.58425	.4327	.01626	.0155
28931 15	4.95565	1.14443	.3919	1.21167	.4122	2.36388	1.0000	.53851	.3989	.01314	.0083
28933 43	4.95427	1.14461	.3959	1.21167	.4122	2.36388	1.0000	.53851	.3989	.01746	.0164
28134 57	4.95316	1.18771	.3735	.88159	.3625	2.36388	1.0000	.58425	.4327	.04512	.0399
28797 15	4.91321	.81126	.2797	1.12949	.4236	2.36388	1.0000	.75397	.5562	.01163	.0114

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                                        COMPOSITE PRODUCT RANKING                                                                     PAGE003
               WEIGHTS           2.915                  2.437              2.365              1.350               1.131
   PRODUCT    COMP INDEX     HISTORICAL GROWTH     FUTURE GROWTH          DISPERSION         TECHNICAL CHANGE          VALUE
                             WEIGHTED  UNWGHTD     WEIGHTED  UNWGHTD     WEIGHTED  UNWGHTD    WEIGHTED  UNWGHTD     WEIGHTED  UNWGHTD
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   28691 99    4.95961       1.18133   .4097        .86255   .3549       2.36000   1.0000      .53851   .3989       .00122   .0012
   28794 99    4.94629        .80446   .2773       1.12949   .4236       2.36000   1.0000      .75397   .5562       .00143   .0012
   28914 91    4.94474        .81562   .2813       1.22425   .5138       2.36000   1.0000      .53851   .3989       .00551   .0048
   28695 51    4.94316       1.17013   .4034        .86255   .3549       2.36000   1.0000      .53851   .3989       .01195   .0105
   28699 77    4.94077       1.17461   .4051        .86255   .3549       2.36000   1.0000      .53851   .3989       .00473   .0041
   28512 95    4.94016       1.17232   .4042        .86255   .3549       2.36000   1.0000      .53851   .3989       .00676   .0059
   28972 99    4.93321       1.02853   .3551       1.00167   .4122       2.36000   1.0000      .53851   .3989       .00843   .0074
   28692 11    4.93271       1.07633   .3711        .86255   .3549       2.36000   1.0000      .53851   .3989       .05534   .0483
   28653 11    4.93271       1.11977   .3861        .86255   .3549       2.36000   1.0000      .53851   .3989       .05184   .0459
   28972 77    4.92265       1.01601   .3516       1.00167   .4122       2.36000   1.0000      .53851   .3989       .00576   .0051
   28935 45    4.91619       1.01236   .3490       1.00167   .4122       2.36000   1.0000      .53851   .3989       .00358   .0031
   28743 25    4.91459       1.32372   .4688        .94662   .3893       2.36000   1.0000      .23459   .1737       .01426   .0126
   28697 51    4.91297       1.07633   .3711        .86255   .3549       2.36000   1.0000      .53851   .3989       .07558   .0669
   28917 16    4.91163        .78659   .2718       1.22425   .5138       2.36000   1.0000      .53851   .3989       .00084   .0007
   28162 99    4.90655       1.39632   .4856        .51575   .2328       2.36000   1.0000      .58425   .4327       .00055   .0004
   28176 15    4.89978       1.05773   .3647        .88119   .3625       2.36000   1.0000      .58425   .4327       .00684   .0060
   28213 --    4.88916       1.18133   .4097       1.58598   .6526        .71234   .3018       .64775   .4797       .75479   .6679
   28975 71    4.86657        .98261   .3388       1.00167   .4122       2.36000   1.0000      .53851   .3989       .00376   .0033
   28792 42    4.86572        .74438   .2558       1.12949   .4236       2.36000   1.0000      .75397   .5562       .00128   .0012
   28791 19    4.86175        .74269   .2561       1.12949   .4236       2.36000   1.0000      .75397   .5562       .00025   .0002
   28612 --    4.86015       1.08031   .3727        .86255   .3549       2.36000   1.0000      .53851   .3989       .04004   .0354
   28931 19    4.85665        .97121   .3349       1.00167   .4122       2.36000   1.0000      .53851   .3989       .00306   .0027
   28612 57    4.84716       1.10375   .3806        .86255   .3549       2.36000   1.0000      .53851   .3989       .00622   .0055
   28512 91    4.84714       1.09802   .3782        .86255   .3549       2.36000   1.0000      .53851   .3989       .00916   .0081
   28693 31    4.83711       1.05816   .3644        .86255   .3549       2.36000   1.0000      .53851   .3989       .04799   .0424
   28612 34    4.83354       1.09167   .3739        .86255   .3549       2.36000   1.0000      .53851   .3989       .00401   .0035
   28595 --    4.83331       1.04663   .3619        .86255   .3549       2.36000   1.0000      .53851   .3989       .05532   .0489
   28695 31    4.82991       1.09461   .3774        .86255   .3549       2.36000   1.0000      .53851   .3989       .00722   .0063
   28931 --    4.82278        .93105   .3237       1.00167   .4122       2.36000   1.0000      .53851   .3989       .02252   .0199
   28743 75    4.81535       1.29572   .4468        .94662   .3893       2.36000   1.0000      .23459   .1737       .00213   .0019
   28695 94    4.81501       1.15795   .3956        .86255   .3549       2.36000   1.0000      .53851   .3989       .01439   .0127
   28692 11    4.80275       1.03973   .3585        .86255   .3549       2.36000   1.0000      .53851   .3989       .02441   .0215
   28611 31    4.79983       1.04493   .3517        .86255   .3549       2.36000   1.0000      .53851   .3989       .00904   .0080
   28167 39    4.79367       1.29811   .4475        .51575   .2328       2.36000   1.0000      .58425   .4327       .00159   .0014
   28791 51    4.79588        .66499   .2293       1.12949   .4236       2.36000   1.0000      .75397   .5562       .00015   .0001
   28137 11    4.79317        .96894   .3341        .88119   .3625       2.36000   1.0000      .58425   .4327       .00482   .0042
   28699 49    4.78755       1.03521   .3569        .86255   .3549       2.36000   1.0000      .53851   .3989       .00128   .0011
   28931 15    4.77133        .85611   .2956       1.00167   .4122       2.36000   1.0000      .53851   .3989       .00519   .0045
   28931 16    4.76578        .86153   .2970       1.00167   .4122       2.36000   1.0000      .53851   .3989       .00507   .0044
   28935 --    4.76235        .85963   .2967       1.00167   .4122       2.36000   1.0000      .53851   .3989       .00739   .0065
   28132 --    4.75935        .91419   .3152        .88119   .3625       2.36000   1.0000      .58425   .4327       .01963   .0173
   28617 11    4.74349        .98263   .3388        .86255   .3549       2.36000   1.0000      .53851   .3989       .00653   .0057
   28741 45    4.74179       1.17232   .4042        .94662   .3893       2.36000   1.0000      .23459   .1737       .02747   .0243
   28762 --    4.73527       1.10167   .3798        .96502   .3852       2.36000   1.0000      .23459   .1737       .09623   .0851
   28762 17    4.73301       1.18633   .4097        .94662   .3893       2.36000   1.0000      .23459   .1737       .00927   .0083
   29136 71    4.73346        .90723   .3128        .88119   .3625       2.36000   1.0000      .58425   .4327       .00189   .0017
   28595 11    4.72953        .95294   .3286        .86255   .3549       2.36000   1.0000      .53851   .3989       .01553   .0137
   28611 --    4.72217        .94151   .3246        .86255   .3549       2.36000   1.0000      .53851   .3989       .01956   .0173
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COMPOSITE PRODUCT RANKING

PRODUCT	WEIGHTS	2.900		2.430		2.360		1.350		1.130	
	COMP INDEX	HISTORICAL GROWTH		FUTURE GROWTH		DISPERSION		TECHNICAL CHANGE		VALUE	
		WEIGHTED	UNWGHTD	WEIGHTED	UNWGHTD	WEIGHTED	UNWGHTD	WEIGHTED	UNWGHTD	WEIGHTED	UNWGHTD
28752 79	4.71217	1.16774	.4026	.94602	.3893	2.36000	1.0000	.23458	.1737	.00383	.0033
28913 49	4.71080	.58730	.2025	1.22425	.5038	2.36000	1.0000	.53851	.3989	.00074	.0006
28742 51	4.70665	1.11748	.3853	.94602	.3893	2.36000	1.0000	.23458	.1737	.04857	.0429
28199 73	4.70594	1.34142	.4625	.41735	.1717	2.36000	1.0000	.58425	.4327	.00292	.0025
28163 15	4.70339	1.18833	.4097	.56575	.2328	2.36000	1.0000	.58425	.4327	.00506	.0044
28511 23	4.70267	.93922	.3238	.86255	.3549	2.36000	1.0000	.53851	.3989	.00239	.0021
28791 33	4.69819	.55758	.1922	1.02949	.4236	2.36000	1.0000	.75097	.5562	.00015	.0001
28133 --	4.69270	.85924	.2962	.88109	.3625	2.36000	1.0000	.58425	.4327	.00812	.0071
28741 19	4.67669	1.09918	.3790	.94602	.3893	2.36000	1.0000	.23458	.1737	.03691	.0326
28199 --	4.67559	1.04205	.3593	.41735	.1717	2.36000	1.0000	.58425	.4327	.27194	.2406
28191 --	4.66511	1.13120	.3900	.41735	.1717	2.36000	1.0000	.58425	.4327	.17231	.1524
28742 61	4.66269	1.10835	.3821	.94602	.3893	2.36000	1.0000	.23458	.1737	.01374	.0121
28133 31	4.66041	.83183	.2868	.88109	.3625	2.36000	1.0000	.58425	.4327	.00324	.0028
28199 65	4.65689	1.29116	.4452	.41735	.1717	2.36000	1.0000	.58425	.4327	.00413	.0036
28655 11	4.65540	.87754	.3026	.86255	.3549	2.36000	1.0000	.53851	.3989	.01680	.0149
28511 39	4.65098	.88209	.3041	.86255	.3549	2.36000	1.0000	.53851	.3989	.00783	.0069
28612 33	4.64422	.88209	.3042	.86255	.3549	2.36000	1.0000	.53851	.3989	.00107	.0009
28752 --	4.63312	.96665	.3333	.94602	.3893	2.36000	1.0000	.23458	.1737	.12587	.1113
28163 31	4.63123	1.11293	.3837	.56575	.2328	2.36000	1.0000	.58425	.4327	.00830	.0073
28163 98	4.63075	1.10835	.3821	.56575	.2328	2.36000	1.0000	.58425	.4327	.01240	.0109
28199 23	4.62395	1.25230	.4318	.41735	.1717	2.36000	1.0000	.58425	.4327	.01005	.0089
28163 --	4.62044	1.05122	.3624	.56575	.2328	2.36000	1.0000	.58425	.4327	.05922	.0524
28163 17	4.59829	1.08549	.3743	.56575	.2328	2.36000	1.0000	.58425	.4327	.00280	.0024
28199 17	4.59394	1.22945	.4239	.41735	.1717	2.36000	1.0000	.58425	.4327	.00289	.0025
28163 27	4.59382	1.08091	.3727	.56575	.2328	2.36000	1.0000	.58425	.4327	.00291	.0025
28196 25	4.58711	1.21573	.4192	.41735	.1717	2.36000	1.0000	.58425	.4327	.00978	.0085
28162 21	4.57538	1.04893	.3617	.56575	.2328	2.36000	1.0000	.58425	.4327	.01645	.0145
28731 53	4.57507	1.02834	.3546	.94602	.3893	2.36000	1.0000	.23458	.1737	.00613	.0054
28731 --	4.57286	.87066	.3002	.94602	.3893	2.36000	1.0000	.23458	.1737	.16160	.1430
28199 33	4.57036	1.20656	.4160	.41735	.1717	2.36000	1.0000	.58425	.4327	.00220	.0019
28161 11	4.56953	.98492	.3396	.56575	.2328	2.36000	1.0000	.58425	.4327	.07401	.0655
28215 11	4.56475	1.61567	.5571	1.58598	.6526	.71234	.3018	.64770	.4797	.00306	.0027
28752 13	4.56409	.94151	.3246	.94602	.3893	2.36000	1.0000	.23458	.1737	.08198	.0725
28199 63	4.55799	1.19517	.4121	.41735	.1717	2.36000	1.0000	.58425	.4327	.00122	.0010
28752 61	4.55541	1.01236	.3490	.94602	.3893	2.36000	1.0000	.23458	.1737	.00245	.0021
28163 01	4.55505	1.03750	.3577	.56575	.2328	2.36000	1.0000	.58425	.4327	.00755	.0066
28162 --	4.55031	1.01925	.3514	.56575	.2328	2.36000	1.0000	.58425	.4327	.02111	.0186
28731 52	4.54705	.97350	.3356	.94602	.3893	2.36000	1.0000	.23458	.1737	.03295	.0291
28742 71	4.54446	.99864	.3443	.94602	.3893	2.36000	1.0000	.23458	.1737	.00522	.0046
28731 59	4.54006	.95294	.3286	.94602	.3893	2.36000	1.0000	.23458	.1737	.04652	.0411
28199 91	4.53799	1.17232	.4042	.41735	.1717	2.36000	1.0000	.58425	.4327	.00407	.0036
28742 41	4.53280	.96894	.3341	.94602	.3893	2.36000	1.0000	.23458	.1737	.02326	.0205
28743 --	4.52439	.90265	.3112	.94602	.3893	2.36000	1.0000	.23458	.1737	.08114	.0718
28163 41	4.51774	1.00548	.3467	.56575	.2328	2.36000	1.0000	.58425	.4327	.00226	.0020
28163 45	4.51657	.99635	.3435	.56575	.2328	2.36000	1.0000	.58425	.4327	.01022	.0090
28199 11	4.51506	1.15176	.3971	.41735	.1717	2.36000	1.0000	.58425	.4327	.00170	.0015
28731 61	4.51435	.97121	.3349	.94602	.3893	2.36000	1.0000	.23458	.1737	.00249	.0022
28163 71	4.50537	.99406	.3427	.56575	.2328	2.36000	1.0000	.58425	.4327	.00131	.0011

COMPOSITE PRODUCT RANKING

PRODUCT	COMP INDEX	HISTORICAL GROWTH		FUTURE GROWTH		DISPERSION		TECHNICAL CHANGE		VALUE	
	WEIGHTS	2.960		2.430		2.360		1.350		1.130	
		WEIGHTED	UNWGHTD	WEIGHTED	UNWGHTD	WEIGHTED	UNWGHTD	WEIGHTED	UNWGHTD	WEIGHTED	UNWGHTD
28199 04	4.56165	1.13934	.3924	.41735	.1717	2.36000	1.0000	.58425	.4327	.00101	.0009
28196 27	4.49757	1.12891	.3892	.41735	.1717	2.36000	1.0000	.58425	.4327	.00746	.0066
28194 61	4.49620	1.12203	.3859	.41735	.1717	2.36000	1.0000	.58425	.4327	.01257	.0111
28197 32	4.49423	1.13120	.3910	.41735	.1717	2.36000	1.0000	.58425	.4327	.00143	.0012
28163 14	4.49128	.99037	.3380	.56575	.2328	2.36000	1.0000	.58425	.4327	.00091	.0008
28197 13	4.48911	1.12662	.3884	.41735	.1717	2.36000	1.0000	.58425	.4327	.00089	.0007
28198 --	4.48772	1.09234	.3756	.41735	.1717	2.36000	1.0000	.58425	.4327	.03336	.0295
28741 81	4.48592	.93693	.3230	.94602	.3893	2.36000	1.0000	.23458	.1737	.00939	.0083
28199 49	4.48312	1.11290	.3937	.41735	.1717	2.36000	1.0000	.58425	.4327	.00862	.0076
28197 --	4.48251	.98492	.3396	.41735	.1717	2.36000	1.0000	.58425	.4327	.13599	.1203
28192 --	4.47925	1.07467	.3733	.41735	.1717	2.36000	1.0000	.58425	.4327	.04359	.0385
28731 31	4.47561	.86392	.2978	.94602	.3893	2.36000	1.0000	.23458	.1737	.07119	.0630
28163 13	4.47325	.96217	.3317	.56575	.2328	2.36000	1.0000	.58425	.4327	.00119	.0010
28199 11	4.47226	1.10147	.3798	.41735	.1717	2.36000	1.0000	.58425	.4327	.00919	.0081
28199 19	4.47134	1.09692	.3782	.41735	.1717	2.36000	1.0000	.58425	.4327	.01282	.0113
28211 --	4.46861	1.25871	.4373	1.54599	.6526	.71234	.3018	.64770	.4797	.25527	.2259
28743 39	4.46341	.92550	.3191	.94602	.3893	2.36000	1.0000	.23458	.1737	.00331	.0029
28743 13	4.46174	.86342	.2378	.94602	.3893	2.36000	1.0000	.23459	.1737	.05732	.0507
28213 51	4.45589	1.48540	.5122	1.58598	.6526	.71234	.3018	.64770	.4797	.02447	.0216
28195 --	4.45473	1.01236	.3495	.41735	.1717	2.36000	1.0000	.58425	.4327	.08077	.0714
28199 33	4.45436	1.09234	.3766	.41735	.1717	2.36000	1.0000	.58425	.4327	.00042	.0003
28199 36	4.45117	1.06720	.3680	.41735	.1717	2.76000	1.0000	.58425	.4327	.02237	.0198
28511 13	4.44976	.69785	.2371	.86255	.3549	2.36000	1.0000	.53851	.3989	.00015	.0001
28743 31	4.44893	.90434	.3120	.94602	.3893	2.36000	1.0000	.23459	.1737	.00339	.0030
28196 --	4.44675	1.04893	.3617	.41735	.1717	2.36000	1.0000	.58425	.4327	.03625	.0320
28162 13	4.44376	.93237	.3215	.56575	.2326	2.36000	1.0000	.58425	.4327	.00099	.0008
28612 21	4.44226	.67871	.2340	.86255	.3549	2.36000	1.0000	.53851	.3989	.00049	.0004
28197 51	4.43235	1.06949	.3687	.41735	.1717	2.36000	1.0000	.58425	.4327	.00126	.0011
28199 15	4.42747	1.06499	.3572	.41735	.1717	2.36000	1.0000	.58425	.4327	.00097	.0008
28162 98	4.42705	.91409	.3152	.56575	.2328	2.36000	1.0000	.58425	.4327	.00297	.0026
28199 22	4.41982	1.05577	.3640	.41735	.1717	2.36000	1.0000	.58425	.4327	.00145	.0012
28197 61	4.41957	1.05349	.3612	.41735	.1717	2.36000	1.0000	.58425	.4327	.00349	.0030
28196 71	4.41845	1.05122	.3624	.41735	.1717	2.36000	1.0000	.58425	.4327	.00563	.0049
28197 16	4.41844	1.05348	.3632	.41735	.1717	2.36000	1.0000	.58425	.4327	.00336	.0029
28199 74	4.41209	1.04434	.3631	.41735	.1717	2.36000	1.0000	.58425	.4327	.00615	.0054
28199 57	4.41191	1.04893	.3517	.41735	.1717	2.36000	1.0000	.58425	.4327	.00138	.0012
28197 21	4.41135	1.04215	.3593	.41735	.1717	2.36000	1.0000	.58425	.4327	.00770	.0068
28199 71	4.41093	1.04893	.3617	.41735	.1717	2.36000	1.0000	.58425	.4327	.00037	.0003
28199 37	4.41078	1.04434	.3601	.41735	.1717	2.36000	1.0000	.58425	.4327	.00484	.0042
28752 25	4.40963	.86342	.2978	.94602	.3893	2.36000	1.0000	.23458	.1737	.00358	.0031
28199 24	4.40744	1.03979	.3585	.41735	.1717	2.36000	1.0000	.58425	.4327	.00605	.0053
28199 56	4.40593	1.04215	.3593	.41735	.1717	2.36000	1.0000	.58425	.4327	.00138	.0012
28731 35	4.40318	.83419	.2876	.94602	.3893	2.36000	1.0000	.23458	.1737	.02849	.0252
28194 31	4.40234	1.03750	.3577	.41735	.1717	2.36000	1.0000	.58425	.4327	.00324	.0028
28197 30	4.39653	1.03163	.3553	.41735	.1717	2.36000	1.0000	.58425	.4327	.00430	.0038
28197 87	4.39547	1.00549	.3467	.41735	.1717	2.36000	1.0000	.58425	.4327	.02939	.0260
28199 34	4.39520	1.03292	.3561	.41735	.1717	2.36000	1.0000	.58425	.4327	.00168	.0014
28199 59	4.39170	.98950	.3412	.41735	.1717	2.36000	1.0000	.58425	.4327	.04060	.0359

COMPOSITE PRODUCT RANKING

PRODUCT	WEIGHTS COMP INDEX	2.900 HISTORICAL GROWTH		2.430 FUTURE GROWTH		2.360 DISPERSION		1.350 TECHNICAL CHANGE		1.130 VALUE	
		WEIGHTED	UNWGHTD	WEIGHTED	UNWGHTD	WEIGHTED	UNWGHTD	WEIGHTED	UNWGHTD	WEIGHTED	UNWGHTD
28199 51	4.38349	1.026.7	.3538	.41735	.1717	2.36000	1.0000	.58425	.4327	.00222	.0019
28193 31	4.38931	.98492	.3396	.41735	.1717	2.36000	1.0000	.58425	.4327	.04279	.0378
28193 --	4.38923	.97579	.3364	.41735	.1717	2.36000	1.0000	.58425	.4327	.05164	.0457
28197 27	4.38391	1.02378	.3530	.41735	.1717	2.36000	1.0000	.58425	.4327	.00343	.0030
28199 42	4.38649	1.02378	.3530	.41735	.1717	2.36000	1.0000	.58425	.4327	.00111	.0009
28197 41	4.38335	1.01236	.3496	.41735	.1717	2.36000	1.0000	.58425	.4327	.00939	.0083
28196 55	4.38137	1.01923	.3514	.41735	.1717	2.36000	1.0000	.58425	.4327	.00057	.0005
28194 47	4.37954	1.01236	.3496	.41735	.1717	2.36000	1.0000	.58425	.4327	.00598	.0053
28197 38	4.37967	.98721	.3404	.41735	.1717	2.36000	1.0000	.58425	.4327	.02996	.0264
28199 32	4.37363	.99864	.3443	.41735	.1717	2.36000	1.0000	.58425	.4327	.01336	.0118
28196 51	4.37323	1.01033	.3451	.41735	.1717	2.36000	1.0000	.58425	.4327	.01070	.0094
28199 14	4.37221	1.00322	.3459	.41735	.1717	2.36000	1.0000	.58425	.4327	.00539	.0047
28163 11	4.36969	.85924	.2962	.56575	.2328	2.36000	1.0000	.58425	.4327	.00045	.0004
28197 94	4.36995	1.00548	.3467	.41735	.1717	2.36000	1.0000	.58425	.4327	.00109	.0016
28731 11	4.36984	.82038	.2828	.94612	.3893	2.36000	1.0000	.23458	.1737	.00766	.0067
28190 75	4.36815	1.00548	.3457	.41735	.1717	2.36000	1.0000	.58425	.4327	.00107	.0009
28211 15	4.36903	1.41695	.4985	1.58599	.6526	.71234	.3018	.64770	.4797	.00516	.0045
28197 36	4.36767	.99864	.3443	.41735	.1717	2.36000	1.0000	.58425	.4327	.00343	.0030
28199 13	4.36271	.99864	.3443	.41735	.1717	2.36000	1.0000	.58425	.4327	.00247	.0021
28921 71	4.36230	1.13575	.3916	.32459	.1335	2.36000	1.0000	.53851	.3989	.00345	.0030
28199 52	4.36162	.99635	.3435	.41735	.1717	2.36000	1.0000	.58425	.4327	.00267	.0023
28194 18	4.35937	.99180	.3420	.41735	.1717	2.36000	1.0000	.58425	.4327	.00597	.0052
28197 37	4.35474	.99190	.3420	.41735	.1717	2.36000	1.0000	.58425	.4327	.00134	.0011
28197 28	4.35151	.98951	.3412	.41735	.1717	2.36000	1.0000	.58425	.4327	.00040	.0003
28193 11	4.34946	.98037	.3380	.41735	.1717	2.36000	1.0000	.58425	.4327	.00649	.0057
28214 39	4.34916	1.38024	.4759	1.58598	.6526	.71234	.3018	.64770	.4797	.02186	.0193
28199 87	4.34559	.98263	.3388	.41735	.1717	2.36000	1.0000	.58425	.4327	.00136	.0012
28197 43	4.34178	.97579	.3364	.41735	.1717	2.36000	1.0000	.58425	.4327	.00439	.0038
28199 32	4.33690	.97359	.3356	.41735	.1717	2.36000	1.0000	.58425	.4327	.00180	.0016
28199 39	4.33465	.96665	.3333	.41735	.1717	2.36000	1.0000	.58425	.4327	.00640	.0056
28199 92	4.33151	.96665	.3333	.41735	.1717	2.36000	1.0000	.58425	.4327	.00326	.0028
28752 31	4.32919	.78610	.2711	.94612	.3893	2.36000	1.0000	.23458	.1737	.00249	.0022
28199 68	4.32679	.96436	.3325	.41735	.1717	2.36000	1.0000	.58425	.4327	.00082	.0007
28199 98	4.32347	.95978	.3309	.41735	.1717	2.36000	1.0000	.58425	.4327	.00249	.0022
28199 29	4.32119	.95523	.3293	.41735	.1717	2.36000	1.0000	.58425	.4327	.00506	.0044
28197 34	4.31437	.95054	.3278	.41735	.1717	2.36000	1.0000	.58425	.4327	.00213	.0018
28197 33	4.31311	.95164	.3278	.41735	.1717	2.36000	1.0000	.58425	.4327	.00087	.0007
28194 11	4.31271	.94835	.3270	.41735	.1717	2.36000	1.0000	.58425	.4327	.00226	.0020
28196 17	4.31175	.94835	.3270	.41735	.1717	2.36000	1.0000	.58425	.4327	.00180	.0016
28199 35	4.31175	.94835	.3270	.41735	.1717	2.36000	1.0000	.58425	.4327	.00180	.0016
28921 61	4.31846	1.08091	.3727	.32459	.1335	2.36000	1.0000	.53951	.3989	.00445	.0039
28197 17	4.29663	.91637	.3159	.41735	.1717	2.36000	1.0000	.58425	.4327	.01872	.0165
28197 29	4.29449	.93237	.3215	.41735	.1717	2.36000	1.0000	.58425	.4327	.00051	.0004
28199 30	4.29427	.93237	.3215	.41735	.1717	2.36000	1.0000	.58425	.4327	.00025	.0002
28194 --	4.28694	.89351	.3081	.41735	.1717	2.36000	1.0000	.58425	.4327	.03183	.0281
28193 53	4.28543	.92324	.3183	.41735	.1717	2.36000	1.0000	.58425	.4327	.00059	.0005
28213 71	4.28416	1.26373	.4357	1.58598	.6526	.71234	.3018	.64770	.4797	.07441	.0658
28199 97	4.27569	.91403	.3152	.41735	.1717	2.36000	1.0000	.58425	.4327	.00001	.0000

COMPOSITE PRODUCT RANKING

PRODUCT	WEIGHTS COMP INDEX	2.910 HISTORICAL GROWTH		2.430 FUTURE GROWTH	2.360	DISPERSION	1.350	1.130 TECHNICAL CHANGE		VALUE	
		WEIGHTED	UNWGHTD	WEIGHTED	UNWGHTD	WEIGHTED	UNWGHTD	WEIGHTED	UNWGHTD	WEIGHTED	UNWGHTD
28199 35	4.26924	.90723	.3128	.41735	.1717	2.36000	1.0000	.58425	.4327	.00037	.0003
28199 44	4.26775	.90494	.3120	.41735	.1717	2.36000	1.0000	.58425	.4327	.00074	.0006
28213 69	4.26713	1.29116	.4452	1.58598	.6526	.71234	.3018	.64770	.4797	.02997	.0265
28194 41	4.26527	.90265	.3112	.41735	.1717	2.36000	1.0000	.58425	.4327	.00082	.0007
28742 15	4.26421	.71993	.2482	.94602	.3993	2.36000	1.0000	.23458	.1737	.00378	.0033
28311 11	4.25527	1.55157	.5332	2.04044	.8396	.00000	.0000	.63737	.4721	.02559	.0226
28211 05	4.25142	1.29821	.4475	1.58598	.6526	.71234	.3018	.64770	.4797	.00739	.0065
28731 57	4.24019	.72156	.2419	.94602	.3993	2.36000	1.0000	.23458	.1737	.00733	.0062
28213 53	4.24650	1.29821	.4475	1.58598	.6526	.71234	.3018	.64770	.4797	.00247	.0021
28214 --	4.24369	1.11233	.3837	1.58598	.6526	.71234	.3018	.64770	.4797	.18477	.1635
28211 93	4.24319	1.29345	.4450	1.58598	.6526	.71234	.3018	.64770	.4797	.00372	.0033
28199 55	4.24179	.87940	.3033	.41735	.1717	2.36000	1.0000	.58425	.4327	.00039	.0003
28199 53	4.24162	.87980	.3033	.41735	.1717	2.36000	1.0000	.58425	.4327	.00022	.0002
28215 --	4.24101	1.28429	.4429	1.58598	.6526	.71234	.3018	.64770	.4797	.01070	.0094
28199 18	4.23981	.87524	.3018	.41735	.1717	2.36000	1.0000	.58425	.4327	.00197	.0017
28199 66	4.23716	.87524	.3018	.41735	.1717	2.36000	1.0000	.58425	.4327	.00032	.0002
28123 55	4.23275	1.11061	.3829	.11129	.0458	2.36000	1.0000	.58425	.4327	.06660	.0589
28211 45	4.23271	1.28283	.4423	1.58598	.6526	.71234	.3018	.64770	.4797	.00426	.0037
28194 45	4.22943	.86611	.2986	.41735	.1717	2.36000	1.0000	.58425	.4327	.00072	.0006
28197 55	4.22764	.86332	.2978	.41735	.1717	2.36000	1.0000	.58425	.4327	.00226	.0020
28215 31	4.22152	1.27296	.4389	1.58598	.6526	.71234	.3018	.64770	.4797	.00264	.0023
28197 35	4.22031	.85695	.2955	.41735	.1717	2.36000	1.0000	.58425	.4327	.00176	.0015
28747 17	4.21564	.66453	.2288	.94602	.3993	2.36000	1.0000	.23458	.1737	.00040	.0003
28921 43	4.19991	.97350	.3356	.32459	.1335	2.36000	1.0000	.53851	.3989	.00331	.0029
28123 --	4.19678	1.05577	.3640	.11129	.0458	2.36000	1.0000	.58425	.4327	.08547	.0756
28121 --	4.19265	.92395	.3175	.32459	.1335	2.36000	1.0000	.53851	.3989	.04845	.0429
28214 31	4.18723	1.21852	.4200	1.58598	.6526	.71234	.3018	.64770	.4797	.02319	.0205
28197 19	4.18526	.82267	.2836	.41735	.1717	2.36000	1.0000	.58425	.4327	.00099	.0008
28100 72	4.17454	.81124	.2797	.41735	.1717	2.36000	1.0000	.58425	.4327	.00170	.0015
28211 21	4.17120	1.18624	.4089	1.58598	.6526	.71234	.3018	.64770	.4797	.03914	.0346
28214 75	4.17115	1.21573	.4192	1.58598	.6526	.71234	.3018	.64770	.4797	.00830	.0073
28197 33	4.16628	.80443	.2773	.41735	.1717	2.36000	1.0000	.58425	.4327	.00028	.0002
28213 21	4.15579	1.14376	.3936	1.58598	.6526	.71234	.3018	.64770	.4797	.11601	.1026
28211 51	4.15437	1.20653	.4160	1.58598	.6526	.71234	.3018	.64770	.4797	.00235	.0020
28211 25	4.15139	1.20431	.4152	1.58598	.6526	.71234	.3018	.64770	.4797	.00106	.0009
28315 23	4.14913	1.46713	.5059	2.04044	.8396	.00000	.0000	.63737	.4721	.00309	.0027
28199 12	4.14363	.77695	.2679	.41735	.1717	2.36000	1.0000	.58425	.4327	.00507	.0044
28921 45	4.14015	.91428	.3152	.32459	.1335	2.36000	1.0000	.53851	.3989	.00297	.0025
28211 31	4.13722	1.19146	.4074	1.58598	.6526	.71234	.3018	.64770	.4797	.00472	.0041
28731 35	4.12925	.58730	.2025	.94602	.3993	2.36000	1.0000	.23459	.1737	.00035	.0003
28213 95	4.12579	1.16549	.4018	1.58598	.6526	.71234	.3018	.64770	.4797	.01423	.0126
28921 17	4.11515	.87295	.3010	.32459	.1335	2.36000	1.0000	.53851	.3989	.02010	.0177
28121 15	4.10915	1.01465	.3498	.11129	.0458	2.36000	1.0000	.58425	.4327	.03797	.0336
28213 89	4.10726	1.11051	.3829	1.58598	.6526	.71234	.3018	.64770	.4797	.05043	.0446
28121 --	4.10643	1.00777	.3475	.11129	.0458	2.36000	1.0000	.58425	.4327	.04312	.0381
28219 15	4.10513	1.15965	.3995	1.58598	.6526	.71234	.3018	.64770	.4797	.00051	.0004
28211 61	4.09966	1.13575	.3916	1.58598	.6526	.71234	.3018	.64770	.4797	.01689	.0149
28315 99	4.09612	1.41655	.4995	2.04044	.8396	.00000	.0000	.63737	.4721	.00146	.0013

COMPOSITE PRODUCT RANKING

PRODUCT	WEIGHTS	2.930		2.430		2.360		1.350		1.130	
	COMP INDEX	HISTORICAL GROWTH		FUTURE GROWTH		DISPERSION		TECHNICAL CHANGE		VALUE	
		WEIGHTED	UNWGHTD	WEIGHTED	UNWGHTD	WEIGHTED	UNWGHTD	WEIGHTED	UNWGHTD	WEIGHTED	UNWGHTD
28743 51	4.10143	.55273	.1939	.94622	.3893	2.36000	1.0000	.23459	.1737	.00012	.0001
28215 48	4.10114	1.14553	.3932	1.58598	.6526	.71234	.3018	.64770	.4797	.00479	.0042
28124 22	4.09157	1.03163	.3553	.11129	.0458	2.36000	1.0000	.58425	.4327	.00440	.0039
28124 --	4.08629	1.02378	.3536	.11129	.0458	2.36000	1.0000	.58425	.4327	.00697	.0061
28213 99	4.08434	1.13814	.3874	1.58598	.6526	.71234	.3018	.64770	.4797	.00028	.0002
28122 41	4.06439	.99183	.3420	.11129	.0458	2.36000	1.0000	.58425	.4327	.01704	.0150
28211 23	4.06157	1.10406	.3914	1.58598	.6526	.71234	.3018	.64770	.4797	.01149	.0101
28211 45	4.05728	1.08776	.3710	1.58598	.6526	.71234	.3018	.64770	.4797	.02351	.0208
28122 31	4.05633	.99864	.3443	.11129	.0458	2.36000	1.0000	.58425	.4327	.00215	.0019
28217 11	4.05337	1.05823	.3648	1.58598	.6526	.71234	.3018	.64770	.4797	.04912	.0434
28197 83	4.04755	.68556	.2364	.41735	.1717	2.36000	1.0000	.58425	.4327	.00039	.0003
28122 --	4.04363	.95752	.3301	.11129	.0458	2.36000	1.0000	.58425	.4327	.03057	.0270
28211 63	4.04244	1.07862	.3719	1.58598	.6526	.71234	.3018	.64770	.4797	.01780	.0157
28214 11	4.03775	1.32115	.4562	2.04044	.8396	.00000	.0000	.63737	.4721	.03879	.0343
28213 51	4.03925	1.04434	.3601	1.58598	.6526	.71234	.3018	.64770	.4797	.04889	.0432
28212 51	4.03075	1.06349	.3667	1.58598	.6526	.71234	.3018	.64770	.4797	.02124	.0188
28122 67	4.03266	.96665	.3333	.11129	.0458	2.36000	1.0000	.58425	.4327	.01047	.0092
28121 11	4.02957	.96394	.3341	.11129	.0458	2.36000	1.0000	.58425	.4327	.00509	.0045
28216 --	4.02033	1.01455	.3498	1.58598	.6526	.71234	.3018	.64770	.4797	.05966	.0528
28214 11	3.99879	1.02657	.3518	1.58598	.6526	.71234	.3018	.64770	.4797	.02620	.0231
28122 45	3.97139	.90494	.3120	.11129	.0458	2.36000	1.0000	.58425	.4327	.01091	.0096
28217 67	3.96155	1.01007	.3443	1.58598	.6526	.71234	.3018	.64770	.4797	.00546	.0048
28212 --	3.94874	.93467	.3223	1.58598	.6526	.71234	.3018	.64770	.4797	.06805	.0602
28311 --	3.94449	1.18375	.4041	2.04044	.8396	.00000	.0000	.63737	.4721	.08293	.0733
28219 41	3.94217	.99193	.3420	1.58598	.6526	.71234	.3018	.64770	.4797	.00422	.0037
28214 21	3.93995	.96665	.3333	1.58598	.6526	.71234	.3018	.64770	.4797	.02729	.0241
28219 --	3.93811	.97808	.3372	1.58598	.6526	.71234	.3018	.64770	.4797	.01401	.0124
28123 51	3.93252	.87066	.3002	.11129	.0458	2.36000	1.0000	.58425	.4327	.00632	.0056
28215 21	3.92975	.95064	.3278	1.58598	.6526	.71234	.3018	.64770	.4797	.03309	.0292
28312 11	3.92648	1.23401	.4255	2.04044	.8396	.00000	.0000	.63737	.4721	.01464	.0129
28124 23	3.91309	.85695	.2955	.11129	.0458	2.36000	1.0000	.58425	.4327	.00059	.0005
28216 11	3.89758	.92553	.3191	1.58598	.6526	.71234	.3018	.64770	.4797	.02603	.0230
28219 19	3.89482	.94393	.3254	1.58598	.6526	.71234	.3018	.64770	.4797	.00487	.0043
28212 13	3.88401	.89122	.3073	1.58598	.6526	.71234	.3018	.64770	.4797	.04677	.0413
28213 75	3.86270	.90255	.3112	1.58598	.6526	.71234	.3018	.64770	.4797	.01413	.0125
28124 96	3.81998	.76325	.2631	.11129	.0458	2.36000	1.0000	.58425	.4327	.00119	.0010
28193 51	3.77981	.41818	.1442	.41735	.1717	2.36000	1.0000	.58425	.4327	.00003	.0000
28313 11	3.77933	1.09776	.3756	2.04044	.8396	.00000	.0000	.63737	.4721	.00376	.0033
28315 --	3.75077	1.05577	.3540	2.04044	.8396	.00000	.0000	.63737	.4721	.01719	.0152
28315 17	3.74782	1.06035	.3656	2.04044	.8396	.00000	.0000	.63737	.4721	.00966	.0085
28219 39	3.65219	.70385	.2427	1.58598	.6526	.71234	.3018	.64770	.4797	.00232	.0020
28213 73	3.54117	.58730	.2025	1.58598	.6526	.71234	.3018	.64770	.4797	.00795	.0069
28211 11	3.47014	.52081	.1796	1.58598	.6526	.71234	.3018	.64770	.4797	.00331	.0029
28315 33	3.44188	.76325	.2631	2.04044	.8396	.00000	.0000	.63737	.4721	.00082	.0007
28190 41	3.37073	.00913	.0031	.41735	.1717	2.36000	1.0000	.58425	.4327	.00000	.0000
28232 41	3.36619	1.03753	.3577	.22258	.0916	.71234	.3018	1.35000	1.0000	.04374	.0387
28229 99	3.34577	.88796	.3065	.91819	.3778	.71234	.3018	.64770	.4797	.17960	.1589
28231 --	3.31533	.95494	.3241	.22258	.0916	.71234	.3018	1.35000	1.0000	.06147	.0544

COMPOSITE PRODUCT RANKING

PRODUCT	COMP INDEX	HISTORICAL GROWTH WEIGHTED	HISTORICAL GROWTH UNWGHTD	FUTURE GROWTH WEIGHTED	FUTURE GROWTH UNWGHTD	DISPERSION WEIGHTED	DISPERSION UNWGHTD	TECHNICAL CHANGE WEIGHTED	TECHNICAL CHANGE UNWGHTD	VALUE WEIGHTED	VALUE UNWGHTD
WEIGHTS		2.900		2.430		2.360		1.350		1.130	
28231 71	3.31259	.99615	.3435	.22259	.0916	.71234	.3018	1.35000	1.0000	.03131	.0277
28232 --	3.24691	.92895	.3175	.22259	.0916	.71234	.3018	1.35000	1.0000	.08074	.0714
28221 11	3.23221	.95294	.3286	.22259	.0916	.71234	.3018	1.35000	1.0000	.01435	.0127
28222 51	3.20733	.95973	.3309	.22259	.0916	.71234	.3018	1.35000	1.0000	.00253	.0022
28231 17	3.20641	.91637	.3159	.22259	.0916	.71234	.3018	1.35000	1.0000	.00472	.0041
28231 15	3.19253	.89667	.3057	.22259	.0916	.71234	.3018	1.35000	1.0000	.01094	.0095
28232 35	3.15256	.86342	.2978	.22259	.0916	.71234	.3018	1.35000	1.0000	.00326	.0028
28232 33	3.15012	.85695	.2955	.22259	.0916	.71234	.3018	1.35000	1.0000	.00815	.0072
28232 11	3.10388	.81353	.2805	.22259	.0916	.71234	.3018	1.35000	1.0000	.00240	.0021
28211 33	2.94677	.00000	.0000	1.58599	.6526	.71234	.3018	.64773	.4797	.00035	.0003
28222 31	2.88276	.54185	.2140	.22259	.0916	.71234	.3018	1.35000	1.0000	.00399	.0035
28431 71	2.61420	1.35054	.4657	.96456	.3969	.00000	.0000	.27294	.2021	.02012	.0178
28421 --	2.60244	1.19933	.4097	.95528	.3931	.00000	.0000	.27294	.2021	.18389	.1627
28423 31	2.57361	1.27365	.4391	.95528	.3931	.00000	.0000	.27294	.2021	.03479	.0307
28426 15	2.51461	1.25459	.4326	.95528	.3931	.00000	.0000	.27294	.2021	.02170	.0192
28332 61	2.49272	1.32066	.4554	.51938	.2137	.00000	.0000	.63737	.4721	.01309	.0115
28423 31	2.47968	1.24566	.4294	.95528	.3931	.00000	.0000	.27294	.2021	.00580	.0051
28332 41	2.45265	1.29115	.4452	.51938	.2137	.00000	.0000	.63737	.4721	.00474	.0042
28423 91	2.44975	1.20663	.4160	.95528	.3931	.00000	.0000	.27294	.2021	.01393	.0123
28423 11	2.43541	1.19746	.4129	.95528	.3931	.00000	.0000	.27294	.2021	.00972	.0086
28423 94	2.41132	1.14947	.3963	.95528	.3931	.00000	.0000	.27294	.2021	.02363	.0209
28423 33	2.40229	1.14252	.3940	.95528	.3931	.00000	.0000	.27294	.2021	.03005	.0266
28430 --	2.40099	1.05826	.3649	.96456	.3969	.00000	.0000	.27294	.2021	.10532	.0932
28431 95	2.38346	1.06949	.3687	.96456	.3969	.00000	.0000	.27294	.2021	.07347	.0650
28423 39	2.37229	1.13575	.3916	.95528	.3931	.00000	.0000	.27294	.2021	.00832	.0073
28423 71	2.36929	1.13604	.3924	.95528	.3931	.00000	.0000	.27294	.2021	.00303	.0026
28314 71	2.35555	1.64194	.5739	.36173	.1488	.10874	.0460	.19032	.1409	.01385	.0123
28424 61	2.34756	1.11748	.3853	.95528	.3931	.00000	.0000	.27294	.2021	.00228	.0020
28331 --	2.34166	1.05577	.3640	.51938	.2137	.00000	.0000	.63737	.4721	.13114	.1160
28431 51	2.34167	1.10147	.3798	.96456	.3969	.00000	.0000	.27294	.2021	.00270	.0023
28423 95	2.34154	1.13376	.3906	.95528	.3931	.00000	.0000	.27294	.2021	.00906	.0080
28332 21	2.32273	1.14714	.3956	.51938	.2137	.00000	.0000	.63737	.4721	.00610	.0054
28423 31	2.31965	1.05122	.3624	.95528	.3931	.00000	.0000	.27294	.2021	.03001	.0265
28332 --	2.30916	1.12273	.3869	.51938	.2137	.00000	.0000	.63737	.4721	.02936	.0259
28424 --	2.30597	.99035	.3415	.95528	.3931	.00000	.0000	.27294	.2021	.08230	.0728
28423 45	2.30315	1.06723	.3680	.95528	.3931	.00000	.0000	.27294	.2021	.00763	.0067
28331 41	2.30117	1.09214	.3766	.51938	.2137	.00000	.0000	.63737	.4721	.05208	.0460
28424 73	2.29753	1.06492	.3672	.95528	.3931	.00000	.0000	.27294	.2021	.00418	.0037
28422 --	2.28661	1.01405	.3498	.95528	.3931	.00000	.0000	.27294	.2021	.04374	.0387
28422 43	2.28275	1.01465	.3498	.95528	.3931	.00000	.0000	.27294	.2021	.03918	.0346
28331 21	2.26869	1.03292	.3561	.51938	.2137	.00000	.0000	.63737	.4721	.07222	.0639
28424 25	2.22673	.99615	.3435	.95528	.3931	.00000	.0000	.27294	.2021	.00213	.0019
28424 44	2.22614	.99416	.3427	.95528	.3931	.00000	.0000	.27294	.2021	.00390	.0033
28347 --	2.22416	1.44143	.4972	.51938	.2137	.00000	.0000	.63737	.4721	.14468	.1280
28426 31	2.22215	.96494	.3341	.95528	.3931	.00000	.0000	.27294	.2021	.02499	.0221
28424 11	2.21959	.98573	.3399	.95528	.3931	.00000	.0000	.27294	.2021	.00813	.0072
28423 31	2.21715	.98492	.3396	.95528	.3931	.00000	.0000	.27294	.2021	.00401	.0035
28424 39	2.21661	.98263	.3389	.95528	.3931	.00000	.0000	.27294	.2021	.00566	.0050

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COMPOSITE PRODUCT RANKING

PRODUCT	COMP INDEX	HISTORICAL GROWTH		FUTURE GROWTH		DISPERSION		TECHNICAL CHANGE		VALUE	
	WEIGHT	2.912		2.431		2.365		1.350		1.130	
		WEIGHTED	UNWGHTD	WEIGHTED	UNWGHTD	WEIGHTED	UNWGHTD	WEIGHTED	UNWGHTD	WEIGHTED	UNWGHTD
28424 55	2.19651	.96436	.7325	.95528	.3931	.00000	.0000	.27294	[illegible]	.00393	.0034
28341 63	2.17551	1.52942	.5271	.00000	.0000	.00000	.0000	.63737	.4721	.00972	.0086
28311 37	2.13575	1.46484	.5051	.36170	.1488	.10974	.0460	.19032	.1409	.01045	.0092
28427 97	2.11574	.89846	.3565	.95528	.3931	.00000	.0000	.27294	.2021	.03106	.0339
28427 53	2.10315	.87754	.3626	.95528	.3931	.00000	.0000	.27294	.2021	.00339	.0030
28475 11	2.10571	.86342	.2978	.96456	.3969	.00000	.0000	.27294	.2021	.00499	.0044
28342 --	2.10368	1.12203	.3859	.00000	.0000	.00000	.0000	.63737	.4721	.34409	.3045
28415 71	2.07731	.83568	.2332	.96456	.3969	.00000	.0000	.27294	.2021	.00292	.0025
28519 53	2.07257	1.40771	.4854	.36170	.1488	.10974	.0460	.19032	.1409	.00410	.0036
28512 --	2.07054	1.36427	.4714	.36170	.1488	.10974	.0460	.19032	.1409	.04595	.0406
28332 99	2.05513	.83811	.3296	.51938	.2137	.00000	.0000	.63737	.4721	.00028	.0002
28345 77	2.04439	1.41542	.4446	.00000	.0000	.00000	.0000	.63737	.4721	.01220	.0108
28342 95	2.03924	1.39171	.4799	.00000	.0000	.00000	.0000	.63737	.4721	.03916	.0381
28424 42	[illegible]	.81663	.2791	.95528	.3931	.00000	.0000	.27294	.2021	.00220	.0019
28345 75	2.02993	1.38257	.4757	.00000	.0000	.00000	.0000	.63737	.4721	.00899	.0079
28332 41	2.02437	.85611	.2986	.51938	.2137	.00000	.0000	.63737	.4721	.00151	.0013
28513 99	2.02149	1.35514	.4672	.36170	.1488	.10874	.0460	.19032	.1409	.00559	.0049
28349 45	2.02125	1.38629	.4759	.00000	.0000	.00000	.0000	.63737	.4721	.00361	.0032
28346 11	2.01359	1.35059	.4657	.00000	.0000	.00000	.0000	.63737	.4721	.03164	.0280
28343 39	2.01926	1.36427	.4714	.00000	.0000	.00000	.0000	.63737	.4721	.01662	.0147
28424 98	2.01486	.79394	.2752	.95528	.3931	.00000	.0000	.27294	.2021	.00279	.0024
28344 11	2.01346	1.37573	.4743	.00000	.0000	.00000	.0000	.63737	.4721	.00039	.0003
28372 13	2.00792	.84781	.2923	.51938	.2137	.00000	.0000	.63737	.4721	.00336	.0029
28511 34	2.00594	1.34371	.4613	.36170	.1488	.10874	.0460	.19032	.1409	.00237	.0021
28362 57	1.98777	1.26602	.4365	.00000	.0000	.00000	.0000	.63737	.4721	.08439	.0746
28518 39	1.97969	1.29851	.4475	.36170	.1488	.10874	.0460	.19032	.1409	.01391	.0123
28423 96	1.96634	.73594	.2537	.95528	.3931	.00000	.0000	.27294	.2021	.00228	.0020
28343 49	1.96436	1.30714	.4507	.00000	.0000	.00000	.0000	.63737	.4721	.01985	.0175
28514 31	1.95976	1.29346	.4460	.36170	.1488	.10874	.0460	.19032	.1409	.00449	.0039
28346 17	1.95734	1.31172	.4523	.00000	.0000	.00000	.0000	.63737	.4721	.00830	.0073
28343 55	1.95153	1.31499	.4499	.00000	.0000	.00000	.0000	.63737	.4721	.00928	.0082
28519 41	1.95596	1.26602	.4365	.36170	.1488	.10874	.0460	.19032	.1409	.01318	.0116
28347 13	1.93979	1.27765	.4450	.00000	.0000	.00000	.0000	.63737	.4721	.00726	.0064
28349 25	1.93267	1.26144	.4349	.00000	.0000	.00000	.0000	.63737	.4721	.03386	.0299
28344 55	1.93174	1.29116	.4452	.00000	.0000	.00000	.0000	.63737	.4721	.00251	.0022
28346 99	1.92674	1.28659	.4436	.00000	.0000	.00000	.0000	.63737	.4721	.00239	.0021
28517 99	1.92380	1.25919	.4342	.36170	.1488	.10874	.0460	.19032	.1409	.00386	.0034
28349 71	1.92277	1.27974	.4412	.00000	.0000	.00000	.0000	.63737	.4721	.00566	.0050
28516 12	1.92337	1.24546	.4294	.36170	.1488	.10874	.0460	.19032	.1409	.01415	.0125
28519 99	1.91936	1.25081	.4310	.36170	.1488	.10874	.0460	.19032	.1409	.00857	.0075
28516 42	1.91771	1.25011	.4310	.36170	.1488	.10874	.0460	.19032	.1409	.00624	.0055
28516 33	1.91491	1.25011	.4310	.36170	.1488	.10874	.0460	.19032	.1409	.00334	.0029
28516 39	1.90922	1.23413	.4255	.36170	.1488	.10874	.0460	.19032	.1409	.01443	.0127
28348 --	[illegible]	1.05949	.3647	.00000	.0000	.00000	.0000	.63737	.4721	.19604	.1740
28342 51	1.89957	1.24775	.4332	.00000	.0000	.00000	.0000	.63737	.4721	.01345	.0119
28512 11	1.89876	1.20272	.4144	.36170	.1488	.10874	.0460	.19032	.1409	.03579	.0316
28347 61	1.89773	1.23174	.4247	.00000	.0000	.00000	.0000	.63737	.4721	.02862	.0253
28341 19	1.89676	1.24546	.4294	.00000	.0000	.00000	.0000	.63737	.4721	.01353	.0119

COMPOSITE PRODUCT RANKING

PRODUCT	COMP INDEX	HISTORICAL GROWTH		FUTURE GROWTH		DISPERSION		TECHNICAL CHANGE		VALUE	
	WEIGHTS	2.9[illegible]		2.431		2.360		1.350		1.130	
		WEIGHTED	UNWGHTD	WEIGHTED	UNWGHTD	WEIGHTED	UNWGHTD	WEIGHTED	UNWGHTD	WEIGHTED	UNWGHTD
28342 27	1.99529	1.19975	.4137	.00000	.0000	.00000	.0000	.63737	.4721	.05916	.0523
28516 --	1.99[illegible]	1.23979	.3545	.36170	.1488	.10874	.0460	.19032	.1409	.19350	.1712
28343 --	1.99370	1.17693	.4658	.00000	.0000	.00000	.0000	.63737	.4721	.07951	.0703
28342 59	1.99259	1.25459	.4326	.00000	.0000	.00000	.0000	.63737	.4721	.00012	.0001
28511 93	1.99134	1.22251	.4215	.36170	.1488	.10874	.0460	.19032	.1409	.00859	.0076
28341 27	1.99195	1.22965	.4239	.00000	.0000	.00000	.0000	.63737	.4721	.02554	.0221
28346 79	1.99145	1.25231	.4318	.00000	.0000	.00000	.0000	.63737	.4721	.00219	.0019
28341 --	1.99169	1.13129	[illegible]	.00000	.0000	.00000	.0000	.63737	.4721	.12251	.1084
28343 51	1.98727	1.23443	.4255	.00000	.0000	.00000	.0000	.63737	.4721	.01647	.0145
28345 --	1.98723	1.19776	.3750	.00000	.0000	.00000	.0000	.63737	.4721	.16210	.1434
28347 17	1.97567	1.22716	.4231	.00000	.0000	.00000	.0000	.63737	.4721	.01094	.0096
28515 11	1.97109	1.19975	.4137	.36170	.1488	.10874	.0460	.19032	.1409	.01049	.0092
28342 39	1.96961	1.21573	.4192	.00000	.0000	.00000	.0000	.63737	.4721	.01551	.0137
28344 15	1.96512	1.21344	.4194	.00000	.0000	.00000	.0000	.63737	.4721	.01551	.0137
28344 --	1.96213	1.17375	.3916	.00000	.0000	.00000	.0000	.63737	.4721	.12160	.1070
28516 66	1.95[illegible]	1.18614	.4099	.36170	.1488	.10874	.0460	.19032	.1409	.00620	.0054
28516 41	1.95119	1.18146	.4274	.36170	.1488	.10874	.0460	.19032	.1409	.00897	.0079
28344 51	1.95134	1.20669	.4150	.00000	.0000	.00000	.0000	.63737	.4721	.00707	.0062
28345 31	1.94242	1.23431	.4152	.00000	.0000	.00000	.0000	.63737	.4721	.00074	.0006
28512 41	1.93153	1.17282	.4142	.36170	.1488	.10874	.0460	.19032	.1409	.00645	.0057
28512 14	1.93602	1.17013	.4034	.36170	.1488	.10874	.0460	.19032	.1409	.00613	.0054
28513 51	1.93549	1.17013	.4034	.36170	.1488	.10874	.0460	.19032	.1409	.00470	.0041
28510 --	1.92399	1.09692	.3792	.36170	.1488	.10874	.0460	.19032	.1409	.07131	.0631
28519 99	1.92969	1.16548	.4018	.36170	.1488	.10874	.0460	.19032	.1409	.00245	.0021
28340 75	1.92797	1.16319	.4011	.00000	.0000	.00000	.0000	.63737	.4721	.02741	.0242
28511 37	1.92568	1.15963	.3995	.36170	.1488	.10874	.0460	.19032	.1409	.00732	.0064
28514 --	1.92105	1.07174	.3695	.36170	.1488	.10874	.0460	.19032	.1409	.08941	.0791
28344 39	1.92046	1.17693	.4058	.00000	.0000	.00000	.0000	.63737	.4721	.00619	.0054
28517 41	1.91471	1.15671	.3987	.36170	.1488	.10874	.0460	.19032	.1409	.00163	.0014
28340 61	1.91463	1.17915	.4066	.00000	.0000	.00000	.0000	.63737	.4721	.00190	.0016
28445 --	1.91693	1.14947	.3953	.32459	.1335	.00000	.0000	.00000	.0000	.34277	.3033
28347 --	1.91523	1.17935	.3921	.00000	.0000	.00000	.0000	.63737	.4721	.06951	.0615
28342 75	1.91419	1.17013	.4034	.00000	.0000	.00000	.0000	.63737	.4721	.00679	.0060
28341 21	1.91333	1.14202	.3940	.00000	.0000	.00000	.0000	.63737	.4721	.03334	.0295
28518 44	1.90896	1.13575	.3916	.36170	.1488	.10874	.0460	.19032	.1409	.01245	.0110
28340 21	1.90475	1.08549	.3743	.00000	.0000	.00000	.0000	.63737	.4721	.08589	.0760
28340 55	1.90766	1.16139	.4013	.00000	.0000	.00000	.0000	.63737	.4721	.00918	.0081
28515 52	1.90497	1.11924	.3924	.36170	.1488	.10874	.0460	.19032	.1409	.00603	.0053
28349 --	1.90474	1.11749	.3853	.00000	.0000	.00000	.0000	.63737	.4721	.04953	.0439
283 79	1.80369	1.14947	.3953	.00000	.0000	.00000	.0000	.63737	.4721	.01684	.0149
28340 51	1.80327	1.16549	.4018	.00000	.0000	.00000	.0000	.63737	.4721	.00042	.0003
28342 91	1.80153	1.16039	.4003	.00000	.0000	.00000	.0000	.63737	.4721	.00309	.0027
28518 21	1.80179	1.13575	.3916	.36170	.1488	.10874	.0460	.19032	.1409	.00457	.0040
28341 17	1.80114	1.16039	.4033	.00000	.0000	.00000	.0000	.63737	.4721	.00188	.0016
28342 71	1.79819	1.14499	.3947	.00000	.0000	.00000	.0000	.63737	.4721	.01583	.0140
28340 23	1.79427	1.13575	.3316	.00000	.0000	.00000	.0000	.63737	.4721	.01615	.0143
28516 45	1.79366	1.11147	.3738	.36170	.1488	.10874	.0460	.19032	.1409	.02132	.0188
28519 77	1.78116	1.04949	.3743	.36170	.1488	.10874	.0460	.19032	.1409	.03491	.0309

COMPOSITE PRODUCT RANKING

PRODUCT	WEIGHTS COMP INDEX	2.970 HISTORICAL GROWTH WEIGHTED	 UNWGHTD	2.430 FUTURE GROWTH WEIGHTED	2.360 UNWGHTD	 DISPERSION WEIGHTED	1.350 UNWGHTD	1.130 TECHNICAL CHANGE WEIGHTED	 UNWGHTD	 VALUE WEIGHTED	 UNWGHTD
28515 31	[illegible]	1.11519	.3945	.36170	.1488	.10874	.0460	.19032	.1409	.00445	.0039
[illegible]	1.77996	[illegible]	.3924	.00000	.0000	.00000	.0000	.63737	.4721	.00453	.0040
28344 21	1.77739	1.13129	.3913	.00000	.0000	.00000	.0000	.63737	.4721	.00892	.0078
28344 41	[illegible]	[illegible]	.3735	.00000	.0000	.00000	.0000	.63737	.4721	.05665	.0501
28344 31	1.77657	1.12433	.3877	.00000	.0000	.00000	.0000	.63737	.4721	.01487	.0131
28519 11	[illegible]	1.11290	.3837	.36170	.1488	.10874	.0460	.19032	.1409	.00242	.0021
28342 95	[illegible]	1.12891	.3832	.00000	.0000	.00000	.0000	.63737	.4721	.00812	.0071
28348 59	1.77359	1.13346	.3918	.00000	.0000	.00000	.0000	.63737	.4721	.00176	.0015
[illegible]	[illegible]	1.12433	.3877	.00000	.0000	.00000	.0000	.63737	.4721	.00770	.0069
28341 15	1.76093	1.11290	.3837	.00000	.0000	.00000	.0000	.63737	.4721	.01906	.0168
28516 51	1.76519	1.11376	.3936	.36170	.1488	.10874	.0460	.19032	.1409	.00237	.0021
28345 61	[illegible]	1.11519	.3945	.00000	.0000	.00000	.0000	.63737	.4721	.00929	.0082
28349 47	[illegible]	1.11977	.3961	.00000	.0000	.00000	.0000	.63737	.4721	.00399	.0034
28346 15	[illegible]	[illegible]	.3821	.00000	.0000	.00000	.0000	.63737	.4721	.01314	.0116
28516 13	[illegible]	[illegible]	.3727	.36170	.1488	.10874	.0460	.19032	.1409	.01403	.0124
28349 43	[illegible]	1.11749	.3953	.00000	.0000	.00000	.0000	.63737	.4721	.00890	[illegible]
28311 32	[illegible]	1.09329	.3735	.36170	.1488	.10874	.0460	.19032	.1409	.00798	.0070
28344 25	1.75167	[illegible]	.3821	.00000	.0000	.00000	.0000	.63737	.4721	.00595	.0052
28345 23	1.74977	[illegible]	.3914	.00000	.0000	.00000	.0000	.63737	.4721	.00534	.0047
28516 11	[illegible]	[illegible]	.3622	.36170	.1488	.10874	.0460	.19032	.1409	.06464	.0572
28514 19	[illegible]	1.08320	.3735	.36170	.1488	.10874	.0460	.19032	.1409	.00213	.0018
28345 15	[illegible]	[illegible]	.3580	.00000	.0000	.00000	.0000	.63737	.4721	.03774	.0334
28344 53	[illegible]	1.09776	.3750	.00000	.0000	.00000	.0000	.63737	.4721	.01474	.0130
28342 77	1.73415	[illegible]	.3792	.00000	.0000	.00000	.0000	.63737	.4721	.00386	.0034
28343 11	[illegible]	[illegible]	.3792	.00000	.0000	.00000	.0000	.63737	.4721	.00359	.0031
28519 39	[illegible]	1.07174	.3695	.36170	.1488	.10874	.0460	.19032	.1409	.00376	.0033
28517 11	1.73525	1.06264	.3654	.36170	.1488	.10874	.0460	.19032	.1409	.01185	.0104
28465 61	[illegible]	1.37799	.4751	.32459	.1335	.00000	.0000	.00000	.0000	.03212	.0284
28349 31	1.73461	[illegible]	.3732	.00000	.0000	.00000	.0000	.63737	.4721	.00032	.0002
28513 71	[illegible]	[illegible]	.3597	.36170	.1488	.10874	.0460	.19032	.1409	.00284	.0025
28516 39	[illegible]	[illegible]	.3648	.36170	.1488	.10874	.0460	.19032	.1409	.01252	.0110
28346 35	[illegible]	1.09234	.3756	.00000	.0000	.00000	.0000	.63737	.4721	.00151	.0013
28346 13	1.72746	1.08325	.3735	.00000	.0000	.00000	.0000	.63737	.4721	.00689	.0061
28515 11	[illegible]	1.05349	.3632	.36170	.1488	.10874	.0460	.19032	.1409	.01188	.0105
28343 41	[illegible]	1.07417	.3703	.00000	.0000	.00000	.0000	.63737	.4721	.01440	.0127
28349 23	[illegible]	1.07802	.3719	.00000	.0000	.00000	.0000	.63737	.4721	.00955	[illegible]
28515 --	[illegible]	1.04893	.3617	.36170	.1488	.10874	.0460	.19032	.1409	.01572	.0134
28519 --	[illegible]	1.03521	.3569	.36170	.1488	.10874	.0460	.19032	.1409	.02793	.0247
28345 35	[illegible]	1.07497	.3719	.00000	.0000	.00000	.0000	.63737	.4721	.00697	.0061
28341 35	1.72169	[illegible]	.3727	.00000	.0000	.00000	.0000	.63737	.4721	.00341	.0030
28517 94	[illegible]	[illegible]	.3624	.36170	.1488	.10874	.0460	.19032	.1409	.00830	.0073
28516 31	[illegible]	[illegible]	.3551	.36170	.1488	.10874	.0460	.19032	.1409	.02647	.0234
28512 49	1.71716	[illegible]	.3483	.36170	.1488	.10874	.0460	.19032	.1409	.04633	.0410
28347 95	[illegible]	[illegible]	.3697	.00000	.0000	.00000	.0000	.63737	.4721	.00931	.0082
28344 71	1.71391	1.07178	.3695	.00000	.0000	.00000	.0000	.63737	.4721	.00476	.0042
28349 98	[illegible]	1.07487	.3703	.00000	.0000	.00000	.0000	.63737	.4721	.00091	.0008
28342 75	[illegible]	1.03163	.3553	.00000	.0000	.00000	.0000	.63737	.4721	.04361	.0385
28347 15	[illegible]	[illegible]	.3672	.00000	.0000	.00000	.0000	.63737	.4721	.00815	.0072

COMPOSITE PRODUCT RANKING

PRODUCT	WEIGHTS COMP INDEX	2.900 HISTORICAL GROWTH WEIGHTED	 UNWGHTD	2.430 FUTURE GROWTH WEIGHTED	 UNWGHTD	2.360 DISPERSION WEIGHTED	1.350 UNWGHTD	1.130 TECHNICAL CHANGE WEIGHTED	 UNWGHTD	 VALUE WEIGHTED	 UNWGHTD
28344 35	1.7[illegible]959	1.16722	.3590	.00000	.0000	.00000	.0000	.63737	.4721	.00412	.0035
28341 49	1.71376	1.[illegible]	.3672	.00000	.0000	.00000	.0000	.63737	.4721	.00349	.0030
28345 71	1.71518	1.05122	.3624	.00000	.0000	.00000	.0000	.63737	.4721	.01679	.0148
28442 --	1.70513	1.24038	.4278	.32459	.1335	.00000	.0000	.00000	.0000	.13966	.1236
28511 --	1.70582	.94916	.3276	.36170	.1488	.10874	.0460	.19032	.1409	.09591	.0844
28347 71	1.70[illegible]	1.06406	.3672	.00000	.0000	.00000	.0000	.63737	.4721	.00195	.0017
28517 21	1.70[illegible]	1.02617	.3538	.36170	.1488	.10874	.0460	.19032	.1409	.01626	.0143
28442 11	1.70[illegible]71	1.24039	.4278	.32459	.1335	.00000	.0000	.00000	.0000	.13724	.1214
28346 17	1.69342	1.05349	.3632	.00000	.0000	.00000	.0000	.63737	.4721	.00257	.0022
28345 97	1.69266	1.05122	.3624	.00000	.0000	.00000	.0000	.63737	.4721	.00407	.0036
28345 27	1.69146	1.05348	.3632	.00000	.0000	.00000	.0000	.63737	.4721	.00101	.0009
28349 37	1.68975	1.05122	.3624	.00000	.0000	.00000	.0000	.63737	.4721	.00076	.0006
28345 28	1.68485	1.04474	.3491	.00000	.0000	.00000	.0000	.63737	.4721	.00314	.0027
28344 30	1.68300	1.0[illegible]	.3491	.00000	.0000	.00000	.0000	.63737	.4721	.00228	.0020
28342 79	1.68245	1.04434	.3601	.00000	.0000	.00000	.0000	.63737	.4721	.00074	.0006
28517 --	1.68009	.97121	.3349	.36170	.1488	.10874	.0460	.19032	.1409	.04895	.0433
28344 61	1.67932	1.02834	.3546	.00000	.0000	.00000	.0000	.63737	.4721	.01361	.0120
28518 57	1.67674	1.01[illegible]7	.3493	.36170	.1488	.10874	.0460	.19032	.1409	.00555	.0049
28341 11	1.67613	1.01920	.3514	.00000	.0000	.00000	.0000	.63737	.4721	.01956	.0173
28511 10	1.67573	1.01[illegible]7	.3443	.36170	.1488	.10874	.0460	.19032	.1409	.00423	.0037
28342 17	1.67462	1.03653	.3553	.00000	.0000	.00000	.0000	.63737	.4721	.00652	.0057
28511 28	1.67376	1.01[illegible]7	.3493	.36170	.1488	.10874	.0460	.19032	.1409	.00251	.0022
28345 19	1.67226	1.02617	.3538	.00000	.0000	.00000	.0000	.63737	.4721	.00842	.0074
28445 23	1.67016	1.31471	.4531	.32459	.1335	.00000	.0000	.00000	.0000	.03156	.0279
28513 53	1.66736	.93416	.3227	.36170	.1488	.10874	.0460	.19032	.1409	.01282	.0113
28443 --	1.66611	1.11977	.3851	.32459	.1335	.00000	.0000	.00000	.0000	.22075	.1953
28517 --	1.66466	.93673	.3236	.36170	.1488	.10874	.0460	.19032	.1409	.06697	.0592
28515 18	1.66362	.99416	.3427	.36170	.1488	.10874	.0460	.19032	.1409	.00880	.0077
28347 55	1.66351	1.01[illegible]	.3451	.00000	.0000	.00000	.0000	.63737	.4721	.02531	.0224
28348 11	1.66[illegible]	1.02374	.3530	.00000	.0000	.00000	.0000	.63737	.4721	.00245	.0021
28511 11	1.66252	.93665	.3435	.36170	.1488	.10874	.0460	.19032	.1409	.00546	.0048
28443 63	1.66156	1.27074	.4412	.32459	.1335	.00000	.0000	.00000	.0000	.05753	.0509
28412 --	1.65963	1.01[illegible]7	.3493	.03718	.0152	.00000	.0000	.27294	.2021	.33946	.3004
28349 15	1.65776	1.01920	.3514	.00000	.0000	.00000	.0000	.63737	.4721	.00119	.0010
28514 98	1.65566	.99153	.3424	.36170	.1488	.10874	.0460	.19032	.1409	.00410	.0036
28517 33	1.65373	.99189	.3422	.36170	.1488	.10874	.0460	.19032	.1409	.00122	.0010
28519 11	1.65330	.97[illegible]4	.3372	.36170	.1488	.10874	.0460	.19032	.1409	.01455	.0129
28349 25	1.65[illegible]	1.[illegible]1465	.3438	.00000	.0000	.00000	.0000	.63737	.4721	.00136	.0012
28412 13	1.65322	1.32544	.4570	.03728	.0152	.00000	.0000	.27294	.2021	.01776	.0157
28344 21	1.65146	1.0[illegible]777	.3675	.00000	.0000	.00000	.0000	.63737	.4721	.00672	.0059
28345 40	1.64993	1.01[illegible]7	.3483	.00000	.0000	.00000	.0000	.63737	.4721	.00151	.0013
28516 47	1.64376	.97350	.3356	.36170	.1488	.10874	.0460	.19032	.1409	.00968	.0085
28347 57	1.64365	1.0[illegible]	.3457	.00000	.0000	.00000	.0000	.63737	.4721	.00079	.0007
28347 39	1.643[illegible]	1.0[illegible]	.3457	.00000	.0000	.00000	.0000	.63737	.4721	.00079	.0007
28445 27	1.64319	1.24317	.4286	.32459	.1335	.00000	.0000	.00000	.0000	.07543	.0667
28343 31	1.64[illegible]	1.0[illegible]327	.3459	.00000	.0000	.00000	.0000	.63737	.4721	.00159	.0014
28346 15	1.63975	1.0[illegible]03	.3451	.00000	.0000	.00000	.0000	.63737	.4721	.00146	.0013
28512 19	1.6342[illegible]	.97579	.3364	.36170	.1488	.10874	.0460	.19032	.1409	.00265	.0023

COMPOSITE PRODUCT RANKING

PRODUCT	WEIGHTS COMP INDEX	2.330 HISTORICAL GROWTH WEIGHTED	 UNWGHTD	2.430 FUTURE GROWTH WEIGHTED	 UNWGHTD	2.360 DISPERSION WEIGHTED	1.350 UNWGHTD	1.130 TECHNICAL CHANGE WEIGHTED	 UNWGHTD	 VALUE WEIGHTED	 UNWGHTD
28347 27	1.63186	.97579	.3354	.00000	.0000	.00000	.0000	.63737	.4721	.01870	.0165
28516 37	[illegible]	.95665	.3333	.36170	.1488	.10874	.0460	.19032	.1409	.00264	.0023
28346 19	1.62767	.94721	.3434	.00000	.0000	.00000	.0000	.63737	.4721	.00249	.0022
28513 59	1.62752	.95752	.3301	.36170	.1488	.10874	.0460	.19032	.1409	.00524	.0046
28344 11	1.62262	.97579	.3364	.00000	.0000	.00000	.0000	.63737	.4721	.00584	.0078
28342 41	1.62167	.98077	.3343	.00000	.0000	.00000	.0000	.63737	.4721	.00395	.0035
28349 15	1.61677	.97819	.3372	.00000	.0000	.00000	.0000	.63737	.4721	.00128	.0011
28346 35	1.61512	.97579	.3354	.00000	.0000	.00000	.0000	.63737	.4721	.00334	.0029
28345 11	1.61536	.97579	.3354	.00000	.0000	.00000	.0000	.63737	.4721	.00290	.0024
28346 31	1.61451	.97121	.3349	.00000	.0000	.00000	.0000	.63737	.4721	.00593	.0052
28345 45	1.61437	.97351	.3356	.00000	.0000	.00000	.0000	.63737	.4721	.00345	.0030
28345 37	1.61211	.97350	.3356	.00000	.0000	.00000	.0000	.63737	.4721	.00124	.0011
28513 54	1.60566	.93237	.3215	.36170	.1488	.10874	.0460	.19032	.1409	.01253	.0110
28515 35	1.60274	.93922	.3238	.36170	.1488	.10874	.0460	.19032	.1409	.00226	.0020
28345 21	1.60171	.95752	.3301	.00000	.0000	.00000	.0000	.63737	.4721	.00682	.0060
28349 38	1.59712	.95523	.3293	.00000	.0000	.00000	.0000	.63737	.4721	.00452	.0040
28517 31	1.59534	.92779	.3199	.36170	.1488	.10874	.0460	.19032	.1409	.00679	.0060
28345 47	1.59461	.95523	.3293	.00000	.0000	.00000	.0000	.63737	.4721	.00201	.0017
28511 25	1.59246	.92563	.3191	.36170	.1488	.10874	.0460	.19032	.1409	.00620	.0054
28411 21	1.59145	1.22716	.4231	.03728	.0152	.00000	.0000	.27294	.2021	.05402	.0483
28441 99	1.59140	1.26872	.4365	.32459	.1335	.00000	.0000	.00000	.0000	.00079	.0007
28513 65	1.59327	.91856	.3167	.36170	.1488	.10874	.0460	.19032	.1409	.00585	.0051
28511 24	1.58311	.91637	.3159	.36170	.1488	.10874	.0460	.19032	.1409	.00597	.0052
28344 59	1.58313	.94340	.3254	.00000	.0000	.00000	.0000	.63737	.4721	.00186	.0016
28311 35	1.58274	.91866	.3157	.36170	.1488	.10874	.0460	.19032	.1409	.00332	.0029
28345 39	1.58197	.94340	.3254	.00000	.0000	.00000	.0000	.63737	.4721	.00070	.0006
28511 22	1.58172	.91637	.3159	.36170	.1488	.10874	.0460	.19032	.1409	.00319	.0028
28343 21	1.57964	.93922	.3238	.00000	.0000	.00000	.0000	.63737	.4721	.00145	.0012
28347 14	1.57293	.93237	.3215	.00000	.0000	.00000	.0000	.63737	.4721	.00306	.0027
28345 33	1.57285	.93237	.3215	.00000	.0000	.00000	.0000	.63737	.4721	.00114	.0010
28445 17	1.56965	1.23629	.4263	.32459	.1335	.00000	.0000	.00000	.0000	.00897	.0079
28345 31	1.56584	.92779	.3199	.00000	.0000	.00000	.0000	.63737	.4721	.00072	.0006
28445 14	1.56443	1.22261	.4215	.32459	.1335	.00000	.0000	.00000	.0000	.01763	.0156
28349 55	1.56422	.92324	.3183	.00000	.0000	.00000	.0000	.63737	.4721	.00361	.0032
28441 56	1.56247	1.21662	.4156	.32459	.1335	.00000	.0000	.00000	.0000	.03123	.0276
28517 56	1.55758	.89351	.3081	.36170	.1488	.10874	.0460	.19032	.1409	.00361	.0032
28444 73	1.55589	1.20650	.4160	.32459	.1335	.00000	.0000	.00000	.0000	.02470	.0218
28411 --	1.55134	1.11361	.3429	.03728	.0152	.00000	.0000	.27294	.2021	.13131	.1162
28348 51	1.55165	.91418	.3152	.00000	.0000	.00000	.0000	.63737	.4721	.00020	.0001
28349 33	1.55145	.91418	.3152	.00000	.0000	.00000	.0000	.63737	.4721	.00000	.0000
28443 41	1.54796	1.16319	.4011	.32459	.1335	.00000	.0000	.00000	.0000	.06019	.0532
28342 71	1.54279	.90639	.3124	.00000	.0000	.00000	.0000	.63737	.4721	.00499	.0044
28347 13	1.53912	.89331	.3081	.00000	.0000	.00000	.0000	.63737	.4721	.00824	.0073
28348 41	1.53979	.86810	.2996	.00000	.0000	.00000	.0000	.63737	.4721	.00332	.0029
28445 15	1.53926	1.20431	.4152	.32459	.1335	.00000	.0000	.00000	.0000	.00936	.0082
28511 31	1.53547	.87293	.3010	.36170	.1488	.10874	.0460	.19032	.1409	.00316	.0028
28412 39	1.53147	1.22032	.4208	.03728	.0152	.00000	.0000	.27294	.2021	.00153	.0013
28511 27	1.52942	.85621	.2946	.36170	.1488	.10874	.0460	.19032	.1409	.00153	.0013

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                                        COMPOSITE PRODUCT RANKING                                                          PAGE015
            WEIGHTS            2.970              2.430             2.360              1.350              1.130
 PRODUCT    COMP INDEX    HISTORICAL GROWTH     FUTURE GROWTH            DISPERSION         TECHNICAL CHANGE          VALUE
                          WEIGHTED   UNWGHTD   WEIGHTED   UNWGHTD   WEIGHTED   UNWGHTD   WEIGHTED   UNWGHTD   WEIGHTED   UNWGHTD
----------------------------------------------------------------------------------------------------------------------------------

 28367 51    1.52518       .99439    .3149      .00000    .0000      .00000    .0000      .63737    .4721      .00343    .0030
 28444 79    1.52264      1.14375    .4191      .32459    .1335      .00000    .0000      .00000    .0000      .01430    .0126
 28311 21    1.52238       .97859    .2992      .36170    .1489      .10874    .0460      .19032    .1409      .02291    .0202
 28445 22    1.52221      1.13284    .4113      .32459    .1335      .00000    .0000      .00000    .0000      .00484    .0042
 28411 23    1.51459      1.15433    .4097      .03708    .0152      .00000    .0000      .27294    .2021      .02124    .0188
 28443 17    1.51134      1.12213    .3859      .32459    .1335      .00000    .0000      .00000    .0000      .05669    .0591
 28513 57    1.51232       .84097    .2839      .36170    .1489      .10874    .0460      .19032    .1409      .01059    .0093
 28517 67    1.50272       .81147    .2499      .36170    .1489      .10874    .0460      .19032    .1409      .00099    .0009
 28411 77    1.51249      1.19375    .4191      .03708    .0152      .00000    .0000      .27294    .2021      .00872    .0077
 28341 75    1.51214       .86342    .2978      .00000    .0000      .00000    .0000      .63737    .4721      .00099    .0007
 28364 53    1.49137       .85409    .2947      .00000    .0000      .00000    .0000      .63737    .4721      .00632    .0055
 28445 19    1.49587      1.15548    .4019      .32459    .1335      .00000    .0000      .00000    .0000      .00580    .0051
 28412 13    1.49576      1.15549    .4019      .03708    .0152      .00000    .0000      .27294    .2021      .01986    .0175
 28412 74    1.49454      1.11548    .3867      .03708    .0152      .00000    .0000      .27294    .2021      .17944    .1599
 28367 57    1.49112       .85259    .2939      .00000    .0000      .00000    .0000      .63737    .4721      .00136    .0012
 28441 --    1.49156      1.11519    .3845      .32459    .1335      .00000    .0000      .00000    .0000      .05074    .0449
 28444 --    1.49038      1.05429    .3572      .32459    .1335      .00000    .0000      .00000    .0000      .10089    .0892
 28345 41    1.48437       .84791    .2923      .00000    .0000      .00000    .0000      .63737    .4721      .00319    .0028
 28411 81    1.48497      1.17002    .4034      .03708    .0152      .00000    .0000      .27294    .2021      .00492    .0043
 28349 15    1.48374       .84552    .2915      .00000    .0000      .00000    .0000      .63737    .4721      .00035    .0003
 28445 17    1.48143      1.14073    .3932      .32459    .1335      .00000    .0000      .00000    .0000      .01551    .0137
 28443 21    1.48068      1.13874    .3924      .32459    .1335      .00000    .0000      .00000    .0000      .01745    .0154
 28412 41    1.48076      1.15176    .3971      .03708    .0152      .00000    .0000      .27294    .2021      .01823    .0161
 28413 79    1.47773      1.16548    .4018      .03708    .0152      .00000    .0000      .27294    .2021      .00183    .0016
 28741 77    1.47655       .87674    .2894      .00000    .0000      .00000    .0000      .63737    .4721      .00090    .0007
 28515 48    1.47284       .80440    .2773      .36170    .1489      .10874    .0460      .19032    .1409      .00772    .0069
 28411 25    1.47272      1.15176    .3971      .03708    .0152      .00000    .0000      .27294    .2021      .01094    .0096
 28442 19    1.47165      1.14489    .3947      .32459    .1335      .00000    .0000      .00000    .0000      .00237    .0021
 28445 38    1.46715      1.12662    .3884      .32459    .1335      .00000    .0000      .00000    .0000      .01084    .0095
 28445 30    1.46311      1.12253    .3869      .32459    .1335      .00000    .0000      .00000    .0000      .01349    .0119
 28441 37    1.45746      1.11749    .3853      .32459    .1335      .00000    .0000      .00000    .0000      .01539    .0136
 28347 51    1.45247       .80895    .2789      .00000    .0000      .00000    .0000      .63737    .4721      .00655    .0059
 28347 49    1.45080       .81124    .2797      .00000    .0000      .00000    .0000      .63737    .4721      .00224    .0019
 28445 15    1.45066      1.11749    .3853      .32459    .1335      .00000    .0000      .00000    .0000      .00859    .0076
 28747 41    1.44129       .81124    .2797      .00000    .0000      .00000    .0000      .63737    .4721      .00067    .0006
 28445 61    1.43047      1.08101    .3727      .32459    .1335      .00000    .0000      .00000    .0000      .02492    .0220
 28749 39    1.42464       .78939    .2718      .00000    .0000      .00000    .0000      .63737    .4721      .00270    .0023
 28412 48    1.42437      1.11293    .3837      .03708    .0152      .00000    .0000      .27294    .2021      .00145    .0012
 28411 14    1.42093      1.10606    .3814      .03708    .0152      .00000    .0000      .27294    .2021      .00491    .0043
 28445 21    1.41745      1.06949    .3687      .32459    .1335      .00000    .0000      .00000    .0000      .02307    .0204
 28744 57    1.41475       .77695    .2679      .00000    .0000      .00000    .0000      .63737    .4721      .00003    .0000
 28417 39    1.41332      1.10147    .3798      .03708    .0152      .00000    .0000      .27294    .2021      .00183    .0016
 28445 19    1.41372      1.06949    .3687      .32459    .1335      .00000    .0000      .00000    .0000      .01914    .0169
 28413 25    1.40131      1.07683    .3711      .03708    .0152      .00000    .0000      .27294    .2021      .02295    .0203
 28444 11    1.40515      1.01923    .3514      .32459    .1335      .00000    .0000      .00000    .0000      .06137    .0543
 28413 11    1.39919      1.01691    .3506      .03708    .0152      .00000    .0000      .27294    .2021      .05815    .0513
 28412 31    1.39947      1.01973    .3514      .03708    .0152      .00000    .0000      .27294    .2021      .06225    .0553
 28367 21    1.38976       .73142    .2532      .00000    .0000      .00000    .0000      .63737    .4721      .00057    .0005
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                                        COMPOSITE PRODUCT RANKING                                                     PAGE016
               [illegible]         2.730              2.430              2.350         1.750          1.130
  PRODUCT      [illegible]     HISTORICAL GROWTH    FUTURE GROWTH        DISPERSION         TECHNICAL CHANGE          VALUE
                               WEIGHTED  UNWGHTD   WEIGHTED  UNWGHTD   WEIGHTED  UNWGHTD   WEIGHTED  UNWGHTD   WEIGHTED  UNWGHTD
-----------------------------------------------------------------------------------------------------------------------------

  28411 47    1.34100         1.13816   .3548      .03708   .0152      .00000   .0000      .27294   .2021      .01291   .0114
  28441 16    1.33517         1.14493   .3617      .32459   .1335      .00000   .0000      .00000   .0000      .00185   .0016
  28364 29    1.33167          .73356   .2529      .00000   .0000      .00000   .0000      .63737   .4721      .00065   .0005
  28444 02    1.30955         1.04464   .3611      .32459   .1335      .00000   .0000      .00000   .0000      .00022   .0002
  28443 99    1.30772         1.03979   .3585      .32459   .1335      .00000   .0000      .00000   .0000      .00332   .0029
  28413 --    1.30645          .97171   .3349      .03708   .0152      .00000   .0000      .27294   .2021      .08465   .0749
  28445 43    1.30102         1.01491   .3516      .32459   .1335      .00000   .0000      .00000   .0000      .00852   .0075
  28411 73    1.34777         1.03521   .3559      .03708   .0152      .00000   .0000      .27294   .2021      .00210   .0018
  28411 41    1.34481         1.12607   .3338      .03708   .0152      .00000   .0000      .27294   .2021      .00872   .0077
  28447 39    1.33145         1.00193   .3451      .32459   .1335      .00000   .0000      .00000   .0000      .00593   .0052
  28445 11    1.32675          .99406   .3427      .32459   .1335      .00000   .0000      .00000   .0000      .00810   .0071
  28315 19    1.31272          .65129   .2246      .36170   .1488      .19974   .0460      .19032   .1409      .00018   .0001
  28411 45    1.30672          .98721   .3404      .03708   .0152      .00000   .0000      .27294   .2021      .00959   .0085
  28411 43    1.28907          .94727   .3404      .03708   .0152      .00000   .0000      .27294   .2021      .00267   .0023
  28348 31    1.25120          .66041   .2277      .00000   .0000      .00000   .0000      .63737   .4721      .00051   .0004
  28413 41    1.25203          .96492   .3335      .03708   .0152      .00000   .0000      .27294   .2021      .00186   .0016
  28344 55    1.29357          .65560   .2261      .00000   .0000      .00000   .0000      .63737   .4721      .00030   .0002
  28411 14    1.24355          .97121   .3349      .03708   .0152      .00000   .0000      .27294   .2021      .00432   .0038
  28413 51    1.27257          .94475   .3274      .03708   .0152      .00000   .0000      .27294   .2021      .01420   .0125
  28413 21    1.25772          .93457   .3223      .03708   .0152      .00000   .0000      .27294   .2021      .01301   .0115
  28364 37    1.24567          .66786   .2296      .00000   .0000      .00000   .0000      .63737   .4721      .00040   .0003
  28447 33    1.23347          .90952   .3136      .32459   .1335      .00000   .0000      .00000   .0000      .00536   .0047
  28445 48    1.22376          .90139   .3104      .32459   .1335      .00000   .0000      .00000   .0000      .00328   .0029
  28411 12    1.19919          .88439   .3049      .03708   .0152      .00000   .0000      .27294   .2021      .00479   .0042
  28411 77    1.18973          .87526   .3018      .03708   .0152      .00000   .0000      .27294   .2021      .00407   .0036
  28414 --    1.18451          .86342   .2979      .03708   .0152      .00000   .0000      .27294   .2021      .01067   .0094
  28414 11    1.18836          .86837   .2994      .03708   .0152      .00000   .0000      .27294   .2021      .00195   .0017
  28413 33    1.17760          .85468   .2947      .03708   .0152      .00000   .0000      .27294   .2021      .00899   .0079
  28414 51    1.14744          .83183   .2869      .03708   .0152      .00000   .0000      .27294   .2021      .00559   .0049
  28441 41    1.13618          .81124   .2797      .32459   .1335      .00000   .0000      .00000   .0000      .00035   .0003
  28443 36    1.11236          .78384   .2702      .32459   .1335      .00000   .0000      .00000   .0000      .00393   .0034
  28414 31    1.06774          .77925   .2687      .03708   .0152      .00000   .0000      .27294   .2021      .00103   .0009
  28411 16     .98256          .67144   .2316      .03708   .0152      .00000   .0000      .27294   .2021      .00083   .0007
  28444 31     .96683          .64214   .2214      .32459   .1335      .00000   .0000      .00000   .0000      .00010   .0000
  28441 33     .94781          .62159   .2143      .32459   .1335      .00000   .0000      .00000   .0000      .00084   .0007
  28413 17     .93241          .59957   .2033      .03708   .0152      .00000   .0000      .27294   .2021      .00082   .0007
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APPENDIX G

PRODUCT CODES AND NAMES

TABLE G-1. PRODUCT CODES AND NAMES

Product Code	Product Name
Alkalies and Chlorine	
28121 --	Chlorine, compressed or liquefied:
28121 11	Chlorine gas
28121 15	Chlorine liquid
28122 --	Sodium carbonate (soda ash)
	Synthetic sodium carbonate (58% Na_2O^2):
28122 31	Finished bicarbonate
28122 41	Finished dense ash
28122 45	Finished light ash
28123 --	Sodium hydroxide (caustic soda):
28123 61	68-74% liquid
28122 67	Dry (all forms)
28124 --	Other alkalies:
	Potassium hydroxide (caustic potash) (88-92% KOH):
28124 22	Liquid
28124 23	Solid
28124 90	Other alkalies
Industrial Gases	
28132 --	Acetylene
28133 --	Carbon dioxide
28133 11	Liquid and gas
28133 31	Solid (dry ice)
28134 --	Elemental gases and compressed and liquefied gases, N.E.C.
28134 15	Argon, high purity (99.97-100%)
28134 20	Hydrogen
28134 40	Nitrogen
28134 50	Oxygen
28134 71	Nitrous Oxide
Inorganic Pigments	
28161 11	Titanium pigments, composite and pure (100% T_iO_2)
28162 --	Other white opaque pigments

TABLE G-1. (Continued)

Product Code	Product Name
28162 13	White lead, basic carbonate and sulfate, excluding white lead in oil
28162 21	Lead free zinc oxide pigments
28162 98	All other white opaque pigments, including antimony oxide, lithopone, pure zinc sulfide, and leaded zinc oxide
28162 99	Other white opaque pigments, n.s.k.
28163 --	Chrome colors and other inorganic pigments
28163 11	Chrome green (chrome yellow and iron blue)
28163 13	Chrome oxide green
28163 15	Chrome yellow and orange
28163 17	Molybdate chrome orange
28163 18	Zinc yellow (zinc chromate)
28163 27	White extender pigments including barytes, blank fixe, and whiting
	Color pigments other than chrome colors and lakes and toners:
28163 31	Iron oxide pigments
	Colored lead pigments:
28163 41	Red lead
28163 45	Litharge
28163 51	Iron blues (Prussian Blue, milori blue, etc.)
28163 61	Pearl essence
28163 88	Carbon blacks (bone and lamp) excluding furnace and channel carbon black and charcoal
28163 91	Ceramic colors
28163 99	Chrome colors and other inorganic pigments, n.s.k.
28163 98	All other color pigments, including ultramarine blue (excluding organic pigments, lakes, and toners)
Industrial Inorganic Chemicals	
28192 --	Inorganic and industrial household bleaching compounds
28193 --	Sulfuric acids
	Contact acid:
28193 11	Oleum under 40%
28193 31	Contact acid other than oleum
28193 51	Chamber acid

TABLE G-1. (Continued)

Product Code	Product Name
28194 --	Inorganic acids except nitric and sulfuric
28194 11	Boric (boraic) acid (100% H_3BO_3)
28194 31	Chromic acids (100% CrO_3)
28194 41	Hydrochloric acid including anhydrous (100% Hcl) from salt
28194 45	Hydrochloric acid including anhydrous from chlorine
28194 47	Hydrochloric acid including anhydrous by-products and others
28194 61	Hydrofluoric (100% HF) acid, both anhydrous and technical
28194 98	Other inorganic acids, N.E.C. (including hydrocyanic (including anhydrous (100% HCN), mixed (sulfuric and nitric)
28195 --	Aluminum oxide, except natural alumina (100% Al_2O_3)
28196 --	Other aluminum compounds
28196 17	Anhydrous chloride
28196 25	Hydroxide, trihydrate (100% $Al_2O_3 \bullet 3H_2O$)
28196 27	Fluoride (technical)
28196 51	Commercial sulfate (17% Al_2O_3)
28196 55	Iron free sulfate (17% Al_2O_3)
28196 71	Other inorganic aluminum compounds, including sodium aluminate, light aluminum hydroxide, cryolite, and alums and chloride: liquid (32°Be), crystal (32°Be)
28197 --	Potassium and sodium compounds (except bleaches, alkalies, and alums)
	Potassium Compounds, N.E.C.:
28197 13	Iodide (100% KI)
28197 16	Sulfate (100% K_2SO_4)
28197 18	Tetrapotassium Pyrophosphate
28197 21	Sodium (metal) (100% Na)
	Sodium Compounds, N.E.C.:
28197 27	Chlorate (100% $NaClo_3$)
28197 28	Fluoride
28197 29	Hydrosulfide (sodium sulfhydrate) (100% NaSH)
28197 30	Hydrosulfite (100% $Na_2S_2O_4$)
	Phosphate:

TABLE G-1. (Continued)

Product Code	Product Name
28197 32	Monobasic (100% NaH_2PO_4)
28197 33	Dibasic (100% Na_2HPO_4)
28197 34	Tribasic (100% Na_3PO_4)
28197 35	Tetrabasic (100% $Na_4P_2O_7$)
28197 36	Meta (100% $NaPO_3$)
28197 37	Acid pyro (100% $Na_2H_2P_2O_7$)
28197 38	Tripoly (100% $Na_5P_3O_{10}$)
	Silicates:
28197 41	Soluble silicate glass (water glass), solid and liquid (anhydrous)
28197 43	Metasilicate (100% $Na_2SiO_3 \bullet 5H_2O$)
	Orthosilicate (100% Na_4SiO_4)
28197 51	Silicofluoride (100% Na_2SiF_6)
	Sulfate:
28197 61	High purity (refined) (anhydrous) (100% Na_2SO_4)
28197 65	Low purity (99% or less Na_2SO_4) (salt cake)
	Glauber's salt (100% $Na_2SO_4 \bullet 10H_2O$)
	Sulfide:
28197 82	Concentrated (60-62% Na_2S)
28197 83	Other, including liquid and crystal (60-62% Na_2S)
28197 84	Sulfite (100% Na_2SO_3)
28197 87	Other sodium compounds, N.E.C., other sodium phosphates, borate (borax)
28198 --	Chemical catalytic preparations
28199 --	Other inorganic chemicals
28199 01	Reagent and high purity grades of inorganic chemicals refined from purchased technical grades
28199 02	Antimony compounds (including pigment grades)
28199 03	Arsenic compounds, including white arsenic
	Barium Compounds:
28199 04	Carbonate (precipitated) (100% $BaCO_3$)
28199 06	Other barium compounds
	Bismuth Compounds:
28199 07	Bismuth subcarbonate (100% ($Bi_2O_2CO_3$) H_2O)
28199 09	Other bismuth compounds

TABLE G-1. (Continued)

Product Code	Product Name
28199 10	Bromine (100% Br)
28199 11	Cadmium compounds
	Calcium Compounds:
28199 12	Calcium carbide (commercial)
28199 13	Calcium carbonate (precipitated) (1007 $CaCO_3$)
	Chloride:
28199 14	Solid, excluding flake (73-75% $CaCL_2$), flake (77-80% $CaCl_2$)
28199 16	Liquid chloride (40-45% $CaCl_2$)
	Phosphate: Dibasic:
28199 19	Animal feed grades, other grades (except fertilizer grades)
28199 18	Monobasic phosphate and tribasic phosphate
28199 23	Other inorganic calcium compounds, calcium hypochlorite (high test) (70% available Cl)
	Carbon, activated:
28199 24	Decolorizing, water purification carbon
	Chromium Compounds: Bichromates and Chromates:
28199 29	Sodium bichromate and chromate (hydrous)
28199 32	Other chromium compounds including potassium bichromate and chromate (hydrous) (excluding chrome colors)
28199 33	Cobalt compounds
	Copper Compounds:
28199 35	Cuprous oxide (100% CU_2O)
28199 37	Copper sulfate (100% $CuSO_4 \bullet 5H_2O$)
	Other copper compounds (including copper cyanide, and cupric oxide)
28199 39	Hydrogen peroxide
28199 40	Iodine, crude or resublimed (100% I)
	Iron Compounds:
28199 42	Ferric chloride (100% $FeCl_3$)
28199 44	Ferrous sulfate (100% $FeSO_4 \bullet 7H_2O$)
	Other iron compounds
	Magnesium Compounds:
28199 48	Sulfate, including Epsom salts (100% $MgSO_4$)
	Other magnesium compounds

TABLE G-1. (Continued)

Product Code	Product Name
	Manganese Compounds:
28199 50	Sulfate (100% $MnSO_4 \bullet 4H_2O$)
28199 52	Other manganese compounds, including potassium and other permanganates and manganese dioxide, battery grade
	Mercury Compounds:
28199 53	Mercury, redistilled (lb.)
28199 55	Other mercuric compounds, except mercuric fulminate and medicinal grades
28199 90	Molybendum, platinum, radium, strontium, tantalum, thallium, and tungsten compounds
	Nickel Compounds:
28199 56	Sulfate (100% $NiSO_4 \bullet 6H_2O$)
28199 57	Other nickel compounds
	Phosphorus Compounds: Phosphorus elemental:
28199 58	White (yellow) technical, red (technical)
28199 60	Oxychloride (100% $POCl_3$)
28199 63	Trichloride (chloride) (100% PCl_3)
28199 61	Pentasulfide (100% P_2S_5)
28199 65	Rare earth compounds
28199 66	Selenium compounds
	Silica Gel:
28199 68	Butadiene catalyst grade, desiccant grade, aviation catalyst grade
	Silver Compounds:
28199 71	Cyanide (100% AgCN)
28199 72	Nitrate (100% $AgNO_3$)
28199 73	Other silver compounds
28199 74	Sulfur, recovered elemental
	Sulfur Compounds:
28199 75	Dioxide (produced for sale) (100% SO_2)
	Tin Compounds:
28199 80	Oxide (stannic) (100% SnO_2)
28199 81	Other tin compounds (including stannic and stannous chloride)
	Zinc Compounds:

TABLE G-1. (Continued)

Product Code	Product Name
28199 87	Sulfate (100% $ZnSO_4 \bullet 7H_2O$)
28199 88	Other zinc compounds excluding pigment grades, including zinc chloride (100% $ZnCl_2$)
28199 91	Radioactive isotopes shipped from non-AEC plants producing isotopes
28199 92	Radiation sources and other radioactive materials produced from purchased isotopes
28199 94	Industrial bleaches including liquid lime bleaches
28199 98	All other inorganic chemicals, N.E.C. including activated carbon, deoderizing grade, and solvent recovery and gas absorption grade, other sulfur compounds including sulfur chloride Lead Compounds: Nitrate, other lead compounds (excluding pigment grade)
Plastics Materials and Resins	
28211 --	Unsupported plastics film, sheets, sheeting, rods, tubes, and other stock shapes (made from resins produced in same establishment and made from purchased resins)
28211 11	Cellulosic unsupported film, sheets, and sheeting (less than 3.0 mils and not specified by gauge)
28211 15	Cellulosic unsupported film, sheets, and sheeting (10.0 mils and over)
28211 21	Polyethylene unsupported film, sheets, and sheeting (less than 3.0 mils)
28211 23	Polyethylene unsupported film, sheets, and sheeting (3.0 mils to 9.9 mils)
28211 25	Polyethylene unsupported film, sheets, and sheeting (10.0 mils and over)
28211 31	Polypropylene unsupported film, sheets, and sheeting (less than 3.0 mils)
28211 41	Polystyrene unsupported film, sheets, and sheeting (less than 3.0 mils to 9.9 mils)
28211 45	Polystyrene unsupported film, sheets, and sheeting (10.0 mils and over)
28211 61	Vinyl and vinyl copolymer less than 3.0 mils and not specified by gauge
28211 63	Vinyl and vinyl copolymer (3.0 to 9.9 mils)
28211 65	Vinyl and vinyl copolymer (10.0 mils and over)
28211 83	Cellulosics (unsupported plastic rods, tubes, and other stock shapes, excluding foam)
28211 95	Cellulosics (vinyl and vinyl copolymer)
28211 99	Cellulosics (unsupported plastics film, sheets, sheeting, rods, tubes, and other stock shapes, n.s.k.

TABLE G-1. (Continued)

Product Code	Product Name
28212 --	Regenerated cellulosic products, except rayon
28212 13	Cellophane sheets and rolls, uncoated, nitrocellulose coated, polymer coated
28212 51	Sponges, caps and bands, other regenerated cellulosic products, except rayon, n.s.k.
28213 --	Thermoplastic resins
28213 21	Polyethylene resins, low and medium density (0.940 and under) and high density (over 0.940)
28213 51	Polypropylene resins
28213 61	Polystyrene including rubber modified styrene resins
28213 63	Styrene acrylonitrite (styrene resins)
28213 67	Other styrene copolymers with 50% or more styrene
28213 69	All other styrene and styrene derivative polymers and copolymers including styrene-divinyl benzene and acrylonitrite-butadiene-styrene
28213 71	Vinyl resins, polyvinyl chloride and copolymers with 50% or more polyvinyl chloride
28213 73	Polyvinyl acetate
28213 75	All other vinyl and vinyl copolymer resins
28213 85	Acrylic resins, polyamide (nylon) resins
28213 89	Other thermoplastic resins and materials such as cellulosics acetal, polycarbonate, polyterpine, acrylic resins, fluorocarbons
28213 99	Thermoplastic resins and plastics materials, excluding resins and plastics for protective coatings, n.s.k.
28214 --	Thermosetting resins, excluding resins for protective coatings
28214 11	Melamine, formaldehyde resins, and urea-formaldehyde resins
28214 21	Phenolic and other tar and resins
28214 31	Polyester resins
28214 75	Epoxy resins
28214 98	Other thermosetting resins and plastics materials, including alkyd (not for protective coatings), furan acetone formaldehyde, etc., and thermosetting resins and plastics materials, excluding resins and plastics for protective coatings, n.s.k., silicone resins, cumarone resins (indene and petroleum polymers)
28215 --	Synthetic resin adhesives, from resins manufactured in same establishment

TABLE G-1. (Continued)

Product Code	Product Name
28215 11	Epoxy
28215 31	Urea and melamine
28215 98	All others including combinations (synthetic resin adhesives including phenolic)
28216 --	Synthetic resins for protective coatings
28216 11	Synthetic resins for use in latex base emulsion paints including acrylic, styrene-butadiene, vinyl, etc.
28216 21	Synthetic resins for use in other types of paint
28217 11	Custom compounding of purchased resins
28219 --	Plastics and resin materials, monofilaments not suitable for further manufacturing on textile processing equipment
28219 13	Polyethylene monofilaments
28219 15	Polypropylene monofilaments
28219 19	Other monofilaments (including polyamide nylon)
28219 41	Vulcanized fiber sheets, rods, tubes, and hollowware, semi-manufactured
28219 98	Other plastics and resin materials, N.E.C. excluding photographic film, rayon, acetate, or nitro explosives Cellulose and other plastic film from scrap
Synthetic Rubber	
28229 99	Synthetic rubber
Cellulosic Man-Made Fibers	
28231 --	Acetate yarn
	Packaged Yarn:
28231 11	45 denier (47 denier and finer) 55 denier (48 to 62 denier)
28231 15	75 denier (63 to 87 denier)
28231 17	100 denier (88 to 112 denier)
28231 21	120 denier (113 to 137 denier) 150 denier (138 to 162 denier) 200 denier (163 to 237 denier) 300 denier (238 denier and more) Staple and tow except cigarette filters Other acetate products, N.E.C. including salable waste Acetate yarn, n.s.k.
28232 --	Rayon yarn, viscose, and cuprammonium processes
	Packaged Yarn, including rayon horsehair, straw, etc. (monofilaments by denier):

TABLE G-1. (Continued)

Product Code	Product Name
28232 11	45 denier (47 denier and finer) 55 denier (48 to 62 denier) 75 denier (63 to 87 denier) 100 denier (88 to 112 denier) 125 denier (113 to 137 denier)
28232 23	150 denier (138 to 162 denier)
28232 25	200 denier (163 to 237 denier)
28232 27	250 and 300 denier (238 to 374 denier) 450 denier (375 to 524 denier) 600 denier (525 to 749 denier) 900 denier (750 to 999 denier) 1,100 denier (1,000 to 1,374 denier) 1,650 denier (1,375 denier and more)
28232 41	Staple
28232 51	Tow, waste including staple waste, other rayon products, N.E.C. Rayon yarn, viscose, and cuprammonium processes, n.s.k.
Organic Fibers, Noncellulosic	
28241 --	Polyamide fibers, nylon except monofilaments
28241 15	Filament yarn and textile monofilaments
28241 33	Staple, tow, and salable waste
28242 --	Other noncellulosic synthetic organic fibers
28242 31	Acrylic and modacrylic filament yarn and textile monofilaments, staple, and tow
28242 51	Polyester filament yarn and textile monofilaments, staple, tow, and fiberfill, salable waste for textile use
28242 62	Polyolefin filament yarn and textile filaments
28242 64	Polyolefin film fiber, slit and split, staple, tow, salable waste for textile use
28242 71	Filament yarn and textile monofilaments of other man-made fibers (except glass) including saran, spandex, anidex (extruded and split), vinyon, fluorocarbon, etc.
Biological Products	
28311 --	Biological products for human use: blood and blood derivatives, vaccines and antigens, antitoxins, toxoids and toxins for immunization, therapeutic immune serums, diagnostic substances, other biologics for human use including allergenic extracts, poison ivy and poison oak extracts, etc.
28311 11	Blood and blood derivatives
28312 11	Vaccines and antigens
28313 11	Antitoxins, toxoids, and toxins for immunization and therapeutic immune serums

TABLE G-1. (Continued)

Product Code	Product Name
28314 11	Diagnostic substances and other biologics, including allergenic extracts, poison ivy and poison oak extracts
28315 --	Biological products for veterinary use
28315 13	Vaccines and viruses
28315 23	Bacterins and mixed bacterins
28315 33	Serums
28315 98	Other biologics including antitoxins, toxoids, and diagnostics
Pharmaceutical Preparations	
28341 --	Pharmaceutical preparations affecting neoplasms, endocrine system, and metabolic diseases for human use
	Hormones and synthetic substitutes: Corticoids:
28341 11	Systemic
28341 15	Local and topical, including anti-infective combinations
28341 17	Androgens
28341 19	Estrogens
28341 21	Insulin and anti-diabetic agents and other hormone preparations
28341 25	ACTH
	Progestogens (excluding premenstrual tension preparations):
28341 27	Oral contraceptive preparations, others
28341 35	Thyroid and antithyroid preparations, including iodides
28341 37	Anabolic agents
28341 39	Other hormone preparations
	Antineoplastic agents:
28341 43	Radioactive isotopes for internal use, specific antineoplastic agents
28341 98	Other pharmaceutical preparations affecting neoplasms, the endocrine system, and metabolic diseases Pharmaceutical preparations affecting neoplasms, endocrine system, and metabolic diseases for human use, n.s.k.
28342 --	Pharmaceutical preparations acting on central nervous system and sense organs for human use
28342 13	Skeletal muscle relaxants

TABLE G-1. (Continued)

Product Code	Product Name
	Internal analgesics and antipyretics:
28342 21	Narcotic
	Nonnarcotic:
28342 23	Salicylates, including acetylsalicylic acid
28342 25	Aspirin combinations
28342 27	Anti-arthritics (nonhormonal), other analgesics and antipyretics, including effervescent types and suppositories
	Psychotherapeutic agents:
28342 51	Antidepressants
	Tranquilizers:
28342 55	Phenothiazine derivatives
28342 57	Other tranquilizers, other therapeutic agents
	Central Nervous System (CNS) stimulants (respiratory and cerebral stimulants, including sympathomimetic agents employed mainly as CNS stimulants) (excluding nondrug dietaries for weight control:
28342 61	Amphetamines
28342 63	Anorexiants, except amphetamines
28342 69	Other CNS stimulants
	Sedatives and hypnotics: Ethical:
28342 71	Barbiturates
28342 75	Nonbarbiturates
	Proprietary preparations:
28342 77	Sleep inducers
28342 79	Calming agents
	Anesthetics (except urinary tract anesthetics and skin preparations used as antipruritics):
28342 81	Local and topical
28342 85	General
	Eye and ear preparations (excluding anti-infectives, corticoids, and antibacterials and antiseptics):
28342 91	Mydriatics and miotics
28342 95	Other eye and ear preparations, including contact lens solutions
28342 98	Other pharmaceutical preparations acting on the central nervous system and the sense organs

TABLE G-1. (Continued)

Product Code	Product Name
28342 98	Pharmaceutical preparations acting on the central nervous system and the sense organs for human use, n.s.k.
28343 --	Pharmaceutical preparations acting on the cardiovascular system for human use
28343 11	Anticoagulants
28343 21	Hemostatics
28343 31	Digitalis preparations
	Hypotensives:
28343 41	Rauwolfia-diuretic combinations
28343 45	Rauwolfia
28343 49	Other hypotensives
	Vasodilators:
28343 51	Coronary
28343 55	Peripheral
28343 98	Other pharmaceutical preparations acting on the cardiovascular system, including vasopressors, anti-arrhythmics, and antiheparin agents
	Pharmaceutical preparations acting on the cardiovascular system for human use, n.s.k.
28344 --	Pharmaceutical preparations acting on the respiratory system for human use
28344 11	Antihistamines, except cold preparations and anti-emetics
28344 15	Bronchial dilators, including anti-asthmatics
	Cough preparations and expectorants (containing no antitussive or other ingredient intended primarily to treat cough only):
	Ethical preparations:
28344 21	Narcotic
28344 25	Nonnarcotic
	Cold preparations (containing combinations of the following ingredients, (but no antitussive) nasal decongestant, antihistamine, analgesic, bioflavanoid or antibiotic):
	Ethical preparations:
28344 31	Nasal decongestants
28344 35	Antihistamine cold preparations
28344 39	Other ethical cold preparations
28344 41	Cough and cold combinations (ethical)
	Cough and cold preparations (proprietary):
	Decongestants (including corticoid decongestants):

TABLE G-1. (Continued)

Product Code	Product Name
28344 51	Nasal sprays
28344 55	Nose drops
28344 59	Other decongestants
28344 61	Cough syrups
28344 63	Capsules and tablets
28344 67	Topical preparations
28344 79	Other proprietary cough and cold preparations (including lozenges and cough drops)
28344 98	Other pharmaceutical preparations acting on the respiratory system Pharmaceutical preparations acting on the respiratory system for human use, n.s.k.
28345 --	Pharmaceutical preparations acting on the digestive or genito-urinary systems for human use
	Digestive system preparations:
28345 11	Enzymes
28345 15	Antacids, including acid neutralizing products with coating functions, but excluding effervescent salicylate products classified as analgesics
28345 19	Antidiarrheals
	Laxatives:
28345 21	Irritants
28345 23	Bulk producing
28345 25	Fecal softeners
28345 27	Emollients
28345 28	Saline, enema specialties
28345 31	Digestants
28345 33	Bile therapy preparations, including bile products, choleretics and cholagogues
28345 35	Antinauseants, motion sickness remedies (anti-emetics) including antihistaminic anti-emetic preparations
28345 37	Lipotropics and cholesterol reducers
	Antispasmodics and anticholinergics:
28345 41	Synthetics
28345 43	Ataractic combinations
28345 45	Belladonna and derivatives
28345 49	Other antispasmodics and anticholinergics

TABLE G-1. (Continued)

Product Code	Product Name
28345 59	Other digestive system preparations including emetics
	Genito-urinary preparations:
28345 61	Urinary antibacterials and antiseptics
	Diuretics (excludes aminophylline, xanthine, and rauwolfia-diuretio combinations)
28345 71	Thiazides and related agents
28345 73	Other diuretics
28345 81	Oxytocics
28345 83	Contraceptive agents, except oral contraceptives (aerosols, gels, and creams)
28345 85	Premenstrual tension preparations
28345 87	Vaginal cleaners
28345 98	Other pharmaceutical preparations acting on the genito-urinary system including urinary tract anesthetics
28345 99	Pharmaceutical preparations acting on the digestive or genito-urinary systems for human use, n.s.k.
28346 --	Pharmaceutical preparations acting on the skin for human use
	Dermatological preparations:
28346 11	Emollients and protectives, including burn remedies and ointment bases
28346 13	Antipruritics and local anesthetic skin preparations
28346 15	Coal tar, sulfur, and resorcinol preparations
28346 17	Anti-acne and antiseborrheic preparations
28346 19	Other dermatological preparations
28346 21	Hemorrhoidal preparations
	External analgesics and counter-irritants:
28346 31	Ointments, jellies, pastes, creams, cerates, and salves
28346 35	Liquid (excluding rubbing alcohol but including linaments)
28346 37	Rubbing alcohol
28346 39	Other external analgesics
28346 98	Other pharmaceutical preparations acting on the skin
28346 99	Pharmaceutical preparations acting on the skin for human use, n.s.k.

TABLE G-1. (Continued)

Product Code	Product Name
28347 --	Vitamin, nutrient, and hematinic preparations for human use
	Vitamins:
28347 11	Multivitamins, plain and with minerals, except B-complex vitamins and fish liver oils
28347 13	Pediatric vitamin preparations (drops, suspensions, and chewable tablets)
28347 14	Prenatal vitamin preparations
28347 15	B-complex preparations
28347 17	Fluoride preparations, all other vitamin preparations
28347 21	Fish liver oils (cod, etc.)
28347 31	Nutrients, excluding therapeutic dietary foods and infant formulas
28347 41	Tonics and alternatives
	Hematinics with B_{12}:
28347 51	Oral
28347 53	Parenteral
	Other Hematinics:
28347 55	Oral
28347 57	Parenteral
28347 61	Hospital solutions, including dextran, etc., excluding biologicals (blood plasma)
28347 98	Other vitamin, nutrient, and hematinic preparations
28347 99	Vitamin, nutrient, and hematinic preparations for human use, n.s.k.
28348 --	Pharmaceutical preparations affecting parasitic and infective diseases for human use
	Anti-infective agents (excludes corticoid anti-infective combinations):
28348 11	Amebacides and trichomonacides
28348 15	Anthelmintics
	Systematic antibiotic preparations:
28348 21	Broad and medium spectrum (single or in combinations with other antibiotics)
	Penicillins (single):
28348 23	Injectable
28348 25	Other forms

TABLE G-1. (Continued)

Product Code	Product Name
28348 27	Penicillin-streptomycin and/or dihydrostreptomycin combinations
28348 29	Streptomycin and/or dihydrostreptomycin (single and combinations, except penicillin combinations)
28348 31	Antibiotics in combination with sulfonamides
28348 39	Other systemic antibiotic preparations
28348 41	Topical antibiotic preparations
	Tuberculostatic agents:
28348 51	Izoniasid (isonicotinic acid hydrazade) preparations
28348 55	Other antituberculars
28348 61	Antimalarials (plasmodicides)
28348 63	Sulfonamides, except antibiotic-sulfonamide combinations
28348 65	Antifungal preparations
28348 69	Other anti-infective agents
	Antibacterials and antiseptics:
28348 71	General
28348 75	Mouth and throat preparations
28348 98	Other pharmaceutical preparations affecting parasitic and infective diseases Pharmaceutical preparations affecting parasitic and infective diseases for human use, n.s.k.
28349 --	Pharmaceutical preparations for veterinary use
28349 11	Anesthetics
28349 21	Anthelmintics
28349 23	Antibiotics
28349 25	Antiseptics, wound dressings, and fungicides
28349 31	Hematinics
28349 33	Hemostatics
28349 35	Hormones
28349 37	Intravenous solutions and electrolytes
28349 43	Nutrients and tonics
28349 45	Parasiticides, external
28349 47	Sulfonamides
28349 51	Tranquilizers and ataractics

TABLE G-1. (Continued)

Product Code	Product Name
28349 55	Vitamins and minerals
28349 98	Other pharmaceutical preparations for veterinary use
	Pharmaceutical preparations for veterinary use, n.s.k.
Soap and Other Detergents	
28411 --	Soap and detergents, nonhousehold
	Soaps except specialty cleaners, nonhousehold (bulk products and products sold in containers holding over 25 lbs. or over 1 gallon, for industrial, institutional, or commercial use regardless of package size):
28411 12	Chips, flakes, granulated, powdered, and sprayed, including washing powders
28411 14	Liquid (potash and other, excluding shampoos)
28411 16	Mechanics hand soaps, pastes, and bars, except waterless
28411 18	Other soaps, nonhousehold
	Alkaline detergents, nonhousehold (bulk products and products sold in containers holding over 25 lbs. or 1 gallon, for industrial, institutional, or commercial use regardless of package size):
	Machine dishwashing compounds:
28411 21	Liquid
28411 23	Dry
	Other alkaline detergents, nonhousehold:
28411 25	Liquid
28411 26	Dry, hard surface cleaners, other alkaline detergents
	Synthetic organic detergents, nonhousehold (bulk products and products sold in containers holding over 25 lbs. or over 1 gallon, and for industrial, institutional, or commercial use regardless of package size):
	Dry (powders):
28411 41	Anionic base
28411 43	Nonionic base or other base
	Liquid:
28411 45	Anionic base
28411 47	Nonionic base or other base
28411 48	Scouring cleaners with or without abrasives
	Acid-type cleaners, containing an acid and/or wetting agent, and/or inorganic fillers:

TABLE G-1. (Continued)

Product Code	Product Name
	Dairy, farm, and food plant cleaners, sanitizers, etc.:
28411 61	Halogenated, dry and liquid Nonhalogenated, dry and liquid
	Metal cleaners:
28411 73	Dry and liquid
28411 79	All other metal cleaners
28411 99	Soap and detergents, nonhousehold, n.s.k.
28412 --	Household detergents, alkaline detergents, household (products sold in containers holding 25 lbs. or less and 1 gallon or less, and for use by family units)
	Machine dishwashing compounds:
28412 13	Dry machine dishwashing compounds
	Other alkaline detergents, household:
28412 15	Liquid and dry (powders)
	Synthetic organic detergents, household (products sold in containers holding 25 lbs. or less and 1 gallon or less, for use by family units): Dry (solid or powders):
28412 21	Light duty
	Heavy duty:
28412 24	Phosphate based, phosphate free, hard surface cleaners
	Liquid, excluding shampoos:
28412 31	Light duty
	Hard surface cleaners:
28412 41	Aerosol, other liquid
28412 53	Scouring cleaners, with or without abrasives
28412 99	Household detergents, n.s.k.
28413 --	Soaps, except specialty cleaners, household soaps, except specialty cleaners, household (products sold in containers holding 25 lbs. or less, for use by family units)
	Bars, excluding medical and medicated mechanics' hand soap and shaving soap:
28413 11	Toilet soaps
28413 13	Laundry and other household soaps (bars)
28413 22	Chips, flakes, granulated, powdered, and sprayed, including washing powders

TABLE G-1. (Continued)

Product Code	Product Name
28413 61	Mechanics' hand soaps, all types, except waterless
28413 98	Other soaps, household
28413 99	Soaps, except specialty household cleaners, household, n.s.k.
28414 --	Glycerin, natural
28414 11	Crude glycerin 100% basis
28414 31	High gravity, dynamite, and yellow distilled, 100% basis
28414 51	Chemically pure 100% basis
Polishes and Sanitation Goods	
28422 --	Household Bleaches
28422 43	Household liquid bleaches (sodium hypochlorite, etc.)
28422 53	Household dry bleaches (inorganic base)
28423 --	Specialty cleaning and sanitation products:
28423 11	Glass window cleaning preparations
28423 21	Oven cleaners
28423 31	Toilet bowl cleaner and drain pipe solvent
28423 32	Disinfectants, for uses other than agriculture
28423 51	Rug and upholstery cleaners, consumer-type preparations
28423 71	Household ammonia
	Deoderants, nonpersonal:
28423 81	Aerosol type
28423 85	Other
28423 93	Dry cleaning spotting preparations
	Household laundry and ironing aids:
28423 94	Fabric softeners and rinses
	Laundry starch preparations (resin, starch, etc.):
28423 95	Aerosol
28423 96	Other liquid, dry
28423 91	Ironing aids, for fabric Ironing aids, for iron Other specialty detergents, including sweeping compounds and waterless hand cleaners
28423 99	Specialty cleaning and sanitation products, n.s.k.

TABLE G-1. (Continued)

Product Code	Product Name
28424 --	Polishing preparations and related products
28424 11	Automobile polish and cleaners
28424 15	Furniture polish and cleaners
	Floor polish:
28424 21	Water emulsion
28424 23	Liquid (other than water emulsion)
28424 25	Other than liquid form, including cake and paste
	Shoe polishes and cleaners:
28424 42	Liquid
28424 44	Paste and cake
	Leather dressings and finishes, excluding shoe polish:
28424 61	Leather blackings and stains
28424 65	Other leather dressings and stains
28424 98	Related products, including metal polish and polishing cloths and papers
28424 99	Polishing preparations and related products, n.s.k.
Surface Active Agents	
28430 --	Surface active and finishing agents
	Assistants and finishes, textile and leather:
28430 11	Sulfonated oils and fats
28430 31	Softeners, soluble oils and greases
28430 51	Other assistants
28430 71	Finishes
28430 85	Bulk surfact active agents other than sulfonated oils and fats: - Primarily for purposes other than for detergents (emulsifiers, penetrants, wetting agents, etc.) - Primarily for detergent purposes Includes all amphoteric, anionic, cationic, and nonionic bulk surface active agents that reduce the surface tension of solvents
Toilet Preparations	
28441 --	Shaving preparations
	Shaving soap and cream:
28441 33	Tube and jar
28441 37	Aerosols
28441 41	Stick, powder or cake

TABLE G-1. (Continued)

Product Code	Product Name
28441 56	Aftershave preparations (all forms)
28441 59	Other shaving preparations and styptics
28441 99	Shaving preparations, n.s.k.
28442 --	Perfumes, toilet water, and colognes
28442 11	Perfume oil mixtures and blends Perfumes, liquid and solid Toilet water and colognes (liquid and solid)
28442 99	Perfumes, toilet water, and colognes
28443 --	Hair preparations (including shampoos) Shampoos, including products with additives for tints, coloring or dandruff removal
28443 13	Soap (all forms) Synthetic organic detergents, liquids, creams, and gels
28443 21	Hair tonics, including hair and scalp conditioners
	Perms:
28443 36	Home (complete and refill)
28443 39	Commercial
28443 41	Hair dressings, including brilliantines, creams, and pomades Hair coloring preparations (bleaches, dyes, rinses, tints, etc.)
28443 63	Hair spray, aerosol
28443 65	Hair rinses (excluding color rinses)
28443 98	Other hair preparations, including heat setting wave solutions
28443 99	Hair preparations, n.s.k.
28444 --	Dentifrices, including mouthwashes, gargles, and rinses
28444 11	Toothpaste, including aerosols
28444 31	Toothpowder
28444 73	Mouthwashes and rinses, excluding antiseptic mouthwashes and gargles Breath fresheners, aerosol and liquid
28444 98	Other oral hygiene products, including dental floss and dental adhesives, excluding toothbrushes and toothpicks Includes denture cleaner
28445 --	Other cosmetics and toilet preparations
	Creams, excluding shaving, hair, and deoderant:
28445 11	Cleansing creams

TABLE G-1. (Continued)

Product Code	Product Name
28445 12	Foundation creams
28445 13	Lubricating creams, including hormone creams
28445 14	Other creams
	Lotions and oils, including hair, aftershave, and bath:
28445 15	Suntan, including oils
28445 16	Cleansing lotions
28445 17	Cosmetic oils, including baby oils but excluding suntan oils
28445 18	Hand lotions
28445 19	Other lotions and oils, excluding hair, aftershave, and bath
28445 21	Lip preparations (lipstick, rouge, etc.)
28445 22	Blushers (rouges) excluding lip rouge
28445 23	Eye preparations (mascara, eye shadow, eyeliners, eye creams, etc.)
	Deoderant (personal): Underarm:
28445 27	Aerosol
28445 28	Liquid, cream, roll-on, etc.
28445 29	Feminine hygiene deoderants, all types
	Powder:
28445 41	Talcum and toilet powder
28445 43	Face powder
28445 45	Liquid and compact, for wet application
28445 48	Other powder, including foot powder
28445 61	Bath salts, tablets, oils, and bubble baths
28445 31	All manicuring preparations, nail lacquers and enamels, nail lacquer and enamel removers, other manicuring preparations
28445 98	Other cosmetics and toilet preparations, including depilatories
28445 99	Toilet preparations, n.s.k. for companies with 10 employees or more
Paints and Allied Products	
28511 --	Exterior oil-type trade sales paint products
28511 11	Oil and alkyd vehicle paints in paste and semi-paste form

TABLE G-1. (Continued)

Product Code	Product Name
	Oil paints, enamels, and varnishes in ready-mixed form:
28511 21	Oil and alkyd vehicle house paints and tinting bases
28511 22	Sash, trims, and trellis enamels and tinting bases
28511 24	Porch and deck enamels including interior-exterior floor enamels
28511 25	Undercoaters and primers
28511 27	Barn and roof paints (excluding bituminous paints and roof coatings)
28511 28	Marine paints and enamels (shelf goods)
28511 31	Metallic paints (aluminum, zinc, bronze, etc.)
28511 32	Traffic paints (all types, shelf goods, and highway departments)
28511 33	Automotive and machinery refinish paints and enamels, except lacquers
28511 34	Automotive and machinery refinish primers and undercoaters
28511 35	Varnish, oleoresinous (synthetic and natural)
28511 37	Stains (including shingle and shake)
28511 39	Other exterior oil paints including bituminous paints
28511 99	Exterior oil-type trade sales paint products, n.s.k.
28512 --	Exterior water-type trade sales paint products, including tinting bases
28512 11	All-purpose water emulsion paints and tinting bases (excluding exterior-interior water emulsion paints)
28512 16	Masonry water emulsion paints and tinting bases
28512 19	Other exterior water-thinned paints, including dry types
28512 99	Exterior water-type trade sales paint products, n.s.k.
28513 --	Interior oil-type trade sales paint products
	Oil paints, enamels, and varnishes in ready-mixed form:
28513 52	Flat wall paints and tinting bases including semi-paste (oil and alkyd vehicle)
28513 53	Glass and quick-drying enamels and tinting bases
28513 54	Semigloss paints and tinting bases

TABLE G-1. (Continued)

Product Code	Product Name
28513 56	Undercoaters and primers
28513 59	Other interior oil paints and enamels, N.E.C. including mill white paints and interior marine shelf goods
	Varnishes:
28513 65	Varnishes, except shellac varnishes
28513 67	Shellac varnishes
28513 71	Stains
28513 81	Aerosol paints made from paint produced and packaged in this establishment, or packaged on contact for you
28513 99	Interior oil-type trade sales paint products, n.s.k.
28514 --	Interior water-type trade sales paint products, including tinting bases
28514 11	Flat water emulsion paints and tinting bases
28514 21	Semigloss water emulsion paints and tinting bases
28514 31	All-purpose water emulsion paints
28514 98	Other interior water-thinned paints including paste and semi-paste
28514 99	Interior water-type trade sales paint products, n.s.k.
28515 --	Trade sales lacquers
28515 11	Automotive and machinery refinish lacquers
28515 21	Other trade sales lacquers
28515 99	Trade sales lacquers, n.s.k.
28516 --	Industrial product finishes, except lacquers
	Industrial maintenance paints:
28516 11	Interior (specially formulated coatings for special conditions in the interior of industrial plants requiring protection against extreme temperatures, fungi, chemicals, fumes, etc.)
28516 13	Exterior (specially formulated coatings for special conditions in the exterior of industrial plants requiring protection against extreme temperatures, fungi, chemicals, fumes, etc.)
28516 18	Marine paints, shipbottom, and other specially formulated paints (excluding shelf goods)
	Transportation (original equipment):
28516 31	Automobile finishes
28516 33	Truck and bus finishes

TABLE G-1. (Continued)

Product Code	Product Name
28516 35	Railroad finishes
28516 37	Other transportation equipment, including aircraft, rockets, and missiles
28516 38	Appliance, heating equipment, and air-conditioner finishes
28516 41	Wood furniture and fixture finishes
28516 42	Wood and composition board flat stock finishes
28516 44	Sheet, strip, and coil coatings, including sidings (excluding containers)
	Metal Decorating:
28516 45	Container and closure finishes
28516 46	Other metal decorating
28516 47	Machinery and equipment finishes (including road building equipment and farm implements) (excluding insulating varnish)
28516 48	Metal furniture and fixture finishes
28516 51	Paper and paperboard, excluding pigment binder
28516 52	Insulating varnishes, electrical types
28516 53	Powdered coatings
28516 98	Other industrial product finishes (excluding semimanufactured products such as pigment dispersions and ink vehicles)
28516 99	Industrial product finishes, except lacquers, n.s.k.
28517 --	Industrial lacquers, including acrylics
28517 11	Automotive
28517 21	Wood
28517 31	Fabricated metal
28517 41	Paper and paperboard
28517 98	Industrial lacquers for other end uses
28517 99	Industrial lacquers, including acrylics, n.s.k.
28518 --	Putty and allied products
28518 11	Wood and textile preservatives (nonpressure type)
28518 21	Wood fillers and sealers
28518 53	Putty and glazing compounds
28518 63	Paint and varnish removers
28518 98	Other allied paint products, including brush cleaners

TABLE G-1. (Continued)

Product Code	Product Name
28518 99	Putty and allied products, n.s.k.
28519 --	Miscellaneous paint products
28519 11	Thinners for dopes, lacquers, and oleoresinous thinners, including mixtures and proprietary thinners
28519 41	Aerosol paints made from purchased paint
28519 51	Organisols and plastisols, other than coatings
28519 77	Miscellaneous related paint products, e.g., pigment dispersions, ink vehicles, etc.
28519 99	Miscellaneous paint products, n.s.k.
Gum and Wood Chemicals	
28611 --	Softwood distillation products
28611 13	Wood turpentine
28611 23	Pine oil
28611 31	Wood rosin
28611 98	Other derivatives of softwood distillation, including pine tar, pine tar oil, charcoal, and charcoal briquettes
	Softwood distillation products, n.s.k.
28612 --	Other gum and wood chemicals
28612 11	Gum turpentine
28612 21	Rosin
	Hardwood distillation products:
28612 52	Charcoal, excluding briquettes
	Charcoal briquettes, including blends with lignite or other materials
28612 83	Natural tanning and dyeing materials and chrome tanning mixtures
28612 91	Crude tall oils
28612 94	Refined tall oils (containing less than 90% free fatty acids, including tall oil resins other than tall oil rosins)
28612 96	Rosin (tall oil)
Cyclic Intermediates and Crudes	
28651 11	Cyclic (coal tar) intermediates
28652 11	Synthetic organic dyes
28653 11	Synthetic organic pigments, lakes, and toners
28655 11	Cyclic (coal tar) crudes

TABLE G-1. (Continued)

Product Code	Product Name
Industrial Organic Chemicals	
28691 11	Miscellaneous cyclic (coal tar) chemical products
28692 13	Miscellaneous acyclic chemicals and chemical products, excluding urea
28693 --	Synthetic organic chemicals, N.E.C. except bulk surface active agents
28693 11	Flavor and perfume materials
28693 31	Rubber-processing chemicals
28693 51	Plasticizers
28693 99	Synthetic organic materials, N.E.C., n.s.k.
28694 11	Pesticides and other synthetic organic agricultural chemicals, except preparations
28695 --	Ethyl alcohol and other industrial chemicals, N.E.C.
28695 11	Pure (natural) ethyl alcohol and denatured (special or complete) ethyl alcohol including natural and synthetic, for purposes other than rubbing
28695 31	Flavor oil mixtures and blends
28695 37	Reagent and high purity grades of organic chemicals refined from purchased technical grades
28695 51	Natural organic chemicals, N.E.C.
28695 98	Other industrial organic chemicals
28695 99	Other industrial chemicals, n.s.k.
Nitrogenous Fertilizers	
28731 --	Synthetic ammonia, nitric acid, and ammonium compounds
28731 11	Nitric acid (100% HNO_3)
	Ammonia (100% HN_3):
28731 31	Anhydrous
28731 33	Aqua
	Ammonium compounds:
28731 59	Chloride (100% NH_4Cl), gray, white
	Other ammonium compounds
	Nitrate (100% NH_4NO_3):
	Fertilizer use:
28731 51	Solution
28731 52	Solid
28731 53	Explosive and other uses

TABLE G-1. (Continued)

Product Code	Product Name
28731 55	Nitrogen solutions, including mixtures containing urea (100% N)
28731 57	Sulfate (other than by-product coke oven) (100% $(NH_4)_2 SO_4$)
Phosphatic Fertilizers	
28741 99	Phosphoric acid
28741 81	Phosphoric acid from phosphorus
28741 85	Phosphoric acid from other sources (phosphate rock, etc.)
28742 --	Superphosphate and other phosphatic fertilizer materials
28742 15	Normal and enriched (less than 42% P_2O_5) superphosphates
28742 41	Triple (42% P_2O_5 and over) superphosphates
28742 51	Ammonium phosphates (chemically processed nitrogen-phosphorus materials comprising liquid and solid fertilizer grades of monammonium and diammonium phosphates and their processed combinations with ammonium sulfate
28742 61	Other phosphatic fertilizer materials (chemically processed materials such as ammonium phosphate potash mixtures, nitrophosphate, calcium metaphosphates, sodium phosphates, and wet-base goods)
28742 71	Defluorinated superphosphate and phosphate rock (feed grade)
28743 --	Mixed fertilizers, produced from one or more materials made in the same plant
	Complete mixtures - grades guaranteeing N, P_2O_5, and K_2O (excluding ammonium phosphate potash mixtures, nitrophosphates, calcium metaphosphates, sodium phosphates, and wet-base goods):
28743 13	Shipped in dry form
28743 17	Shipped in liquid form
	Incomplete mixtures, including dry and liquid forms:
28743 25	Grades guaranteeing N and P_2O_5 only, including ammoniated superphosphates
28743 31	Grades guaranteeing P_2O_5 and K_2O only
28743 51	Grades guaranteeing N and K_2O only
28743 78	Grades guaranteeing N, P_2O_5, or K_2O only
28743 99	Mixed fertilizers, n.s.k.

TABLE G-1. (Continued)

Product Code	Product Name
Fertilizers, Mixing Only	
28752 --	Fertilizers, mixing only
	Complete mixtures (grades guaranteeing N, P_2O_5, and K_2O):
28752 13	Shipped in dry form
28752 17	Shipped in liquid form
	Incomplete mixtures, including dry and liquid forms:
28752 25	Grades guaranteeing N and P_2O_5 only, including ammoniated superphosphates
28752 31	Grades guaranteeing P_2O_5 and K_2O only
28752 51	Grades guaranteeing N and K_2O only
28752 78	Grades guaranteeing N, P_2O_5, or K_2O only
Agricultural Chemicals, N.E.C.	
28791 --	Insecticidal preparations (formulations), primarily for agricultural, garden, and health service use
	Insecticidal and other fungicidal preparations (formulations) primarily for agricultural use, excluding aerosols and fly sprays:
28791 19	Arsenic compounds (calcium and lead arsenate)
28791 13	Arsenical insecticides, including Paris Green and other copper arsenicals or mixtures containing arsenicals but excluding weed killers
28791 32	Benzene hexachloride and/or lindane preparations with DDT
	DDT containing preparations:
28791 33	Preparations containing DDT as active ingredient, preparation of DDT and other toxicants
28791 39	Chlorinated hydrocarbon pesticidal preparations other than those containing hexachloride or DDT
28791 43	Organic phosphate containing preparations, preparations containing parathion as the active ingredient, or methyl parathion as the active ingredient, or other organic phosphates as the active ingredient
28791 61	Botanical preparations and/or concentrates for agricultural use
28791 49	Other agricultural insecticidal preparations and/or concentrates including petroleum oil sprays and emulsions without other toxicants, excluding botanicals
	Herbicidal preparations (formulations) primarily for agricultural, garden, and health service use:

TABLE G-1. (Continued)

Product Code	Product Name
28792 81	Sodium arsenate
28792 82	Sodium chlorate preparations
28792 83	2, 4-D (2, 4-dichlorophenoxyacetic acid) and derivatives
28792 84	2, 4, 5-trichlorophenoxyacetic acid and derivatives
28792 85	Other weed killers (hydrocarbon, etc.) including defoliants (except sodium chlorate preparations), desiccants (including arsenic acid), algaecides, carbamates (including CIPC, EPTC, CDAA, etc.)
	Fungicides:
28793 15	Sulfur-containing preparations, including wettable sulfur, sulfur dust, and lime sulfur
28793 65	Seed treatment compounds (insecticides, fungicides, and inoculants)
28793 67	Copper-containing dry preparations, including dry Bordeaux mixtures but excluding Paris Green and copper sulfate
28793 69	Other fungicidal preparations for agricultural use
28793 71	Soil fumigants
28793 98	Other agricultural chemicals, N.E.C. such as disinfectants, animal dips, and soil conditioners
28794 --	Household insecticides and repellants, including industrial exterminants
	Insecticides for flying insects, excluding fumigants:
28794 12	Aerosols
28794 15	Nonaerosols
28794 35	Repellants and attractants for insects, birds, fish, and other animals
28794 71	Rodenticides, fumigants other than soil fumigants, including space
28794 99	Household insecticides and repellants, n.s.k.
Adhesives and Sealants	
28913 --	Natural base glues and adhesives
	Animal glues:
28913 11	Hide (dry forms)
28913 14	Bone, green and extracted (dry forms)
28913 26	Flexible, non-warp, and liquid glue (not glue stock)
	Protein adhesives:
28913 41	Casein adhesives

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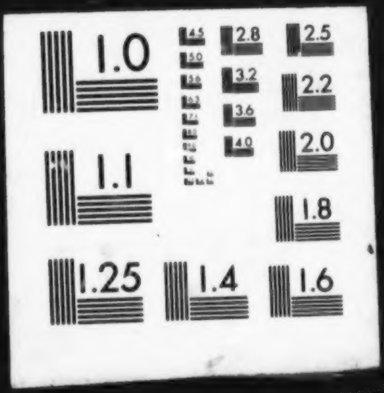
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TABLE G-1. (Continued)

Product Code	Product Name
28913 49	Other, including blood, fish, soybeans, albumen, etc.
	Vegetables adhesives:
28913 51	Dextrines
28913 55	Starches
28913 78	Bituminous adhesives, asphaltic and coal tar
	Other natural base glue and adhesives made from natural gums, shellac, silicates, lacquers, oleoresinous varnishes, etc. except rubber
28914 --	Synthetic resin and rubber adhesives, including all types of bonding and laminating adhesives
28914 11	Epoxy adhesives
	Phenolics and derivatives adhesives
	Phenolics and modified phenolics
	Resorcinol and modified resorcinol
	Urea and modified urea
	Vinyl type adhesives:
	Polyvinyl acetate:
	Latex type
	Solvent type
	Polyvinyl chloride and copolymers
	Other vinyl polymer type adhesives
	Cellulosic type adhesives, nitrocellulose and others
	Acrylic adhesives
	Polyester adhesives
	Polyamide adhesives
	Hot melt adhesives, including nylon, polyolefin, and other hot melts
	Adhesive films, all types, including pressure sensitive structural and nonstructural adhesive films
28914 48	Rubber and synthetic resin combinations
	Rubber cement for sale as such:
28914 81	Latex type
28914 83	Solvent type
28914 99	Synthetic resins and rubber adhesives, n.s.k.
28915 --	Calking compounds and sealants
	Sealants, natural base:
	Calks, modified and unmodified oil base
	Bituminous base (coal tar or asphalt)
	Sealants, synthetic base:
	General performance sealants (PVAC, butyl, vinyl, acrylic, neoprene, etc.)
	Special performance sealants (epoxy, urethane, polysulfide, silicone, etc.)
	Preformed tapes (butyl, polybutene, polyisobutylene, etc.)
Explosives	
28921 --	Explosives, propellants, and blasting accessories (except government-owned, contractor-operated plants)

TABLE G-1. (Continued)

Product Code	Product Name
	Explosives:
28921 17	Ammonium nitrate, fuel sensitized Slurry (all types) Other industrial explosives, including black blasting powder, shaped charges, liquid oxygen explosives, nitroglycerin sold as such, etc. Propellants, including smokeless and black powder Permissibles (approved by Bureau of Mines for underground coal mining)
	Blasting accessories: Detonators:
28921 43	Blasting caps, electric, delay
28921 45	Blasting caps, electric, except delay
28921 71	Other explosives, including military detonators, jet starters, fuse and explosive assemblies
28921 61	Safety fuse Blasting caps, except electric (detonators) Blasting fuse
Printing Ink	
28931 --	Letterpress inks (black and color)
28931 05	News inks
28931 06	Publication inks
28931 15	Packaging inks
28931 19	Other letterpress inks
28932 --	Lithographic and offset inks (black and color)
28932 31	News inks, publication inks
28932 35	Packaging inks
28932 39	Other lithographic and offset inks
28933 --	Gravure inks
28933 43	Packaging inks
28933 45	Publication inks, other gravure inks
28934 --	Flexographic inks
	Packaging inks:
28934 82	Paper and board, film and foil, other flexographic inks
28935 --	Printing inks, N.E.C.
28935 71	Textile printing inks
28935 85	Screen printing inks Other printing inks including stencil inks

TABLE G-1. (Continued)

Product Code	Product Name
Carbon Black	
28959 11	Carbon black (channel and furnace process only)
Chemical Preparations	
28991 11	Evaporated salt (bulk, pressed blocks, and packaged)
28992 --	Fatty acids
	Saturated acids:
28992 11	Stearic acid (40-50% stearic content)
	Hydrogenated animal and vegetable acids:
28992 23	Hydrogenated fatty acids having a maximum titer of 60° and a minimum I.V. of 5 Hydrogenated fatty acids having a minimum titer of 57°C and a maximum I.V. under 5 High palmitic (over 60° palmitic, I.V. maximum 12)
	Hydrogenated fish and marine mammal fatty acids:
28992 53	Coconut-type acids, I.V. of 5 and over, including palm kernel and babassu, and hydrogenated coconut acid Fractionated short-chain fatty acids with I.V. below 5 such as caprylic, capric, lauric, and myristic
	Unsaturated acids:
28992 61	Oleic acid, including white oleic and red oil
28992 83	Other unsaturated fatty acids, including animal fatty acids other than oleic (I.V. 36 to 80), vegetable or marine (I.V. maximum 115), and other unsaturated fatty acids (I.V. 116 and over)
	Tall oil fatty acids:
28992 92	Tall oil fatty acids containing less than 2% rosin acids and more than 95% fatty acids Tall oil fatty acids containing 2% rosin acids or more
28992 99	Fatty acids, n.s.k.
28994 --	Gelatin, except ready-to-eat desserts Photographic grade Technical (inedible) grade Other gelatin products, except ready-to-eat desserts, including unfilled capsules and gelatin sheets for theatrical use
28994 11	Food grade (excluding pharmaceutical and photographic)
28994 31	Pharmaceutical grade (except unfilled capsules)
28995 --	Essential oils, fireworks, and pyrotechnics, sizes, and chemical preparations, N.E.C.

TABLE G-1. (Continued)

Product Code	Product Name
	Essential oils, unblended (natural):
	Citrus oils:
28995 11	Orange
28995 12	Lemon
28995 13	Other
28995 15	Peppermint oils
28995 19	Other natural essential oils
28995 29	Fireworks and pyrotechnics (including flares, jet fuel igniters, railroad torpedoes, toy pistol caps, etc.)
	Chemical preparations, N.E.C.:
	Automotive chemicals:
	Antifreeze preparations:
28995 35	Permanent type
	Other
	Other automotive chemicals (including battery acid, deicing fluid, carbon-removing solvents, etc.)
28995 39	Concrete curing and floor hardening materials
28995 41	Drilling mud materials, mud thinners, thickeners, and purifiers
28995 49	Foundry supplies, chemical (including binders, core oils, core wash, etc.)
28995 55	Insulation products (heat, electrical, other)
28995 59	Metal treating compounds (non-oil base) for nitriding, pickling, drawing, and cutting
28995 61	Oil-treating compounds (non-oil base)
	Sizes:
28995 63	Rosin sizes
	Other, including dextrin sizes
28995 72	Inks (writing and stamp pad ink, including indelible ink and marking fluid, but excluding drawing inks)
	Water-treating compounds:
28995 77	Boiler compounds
	Other water-softening compounds
28995 81	Waterproofing compounds (electrical, leather, masonry, textile, etc.)
28995 87	Vitreous enamel (frit)
28995 91	Plating compounds
28995 93	Lighter fluids (cigarette, charcoal, etc.)

TABLE G-1. (Continued)

Product Code	Product Name
28995 95	Waxes (animal, vegetable, mineral, including blends) excluding pure petroleum waxes
	Other industrial chemical specialties, including fluxes and plastic wood preparations
28995 99	Essential oils, fireworks and pyrotechnics, sizes, and chemical preparations, N.E.C., n.s.k.

Source: U.S. Bureau of the Census, Census of Manufactures, U.S. Government Printing Office (1963, 1967, 1972)

N.E.C. - Not elsewhere classified

n.s.k. - Not specified by kind